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BEING

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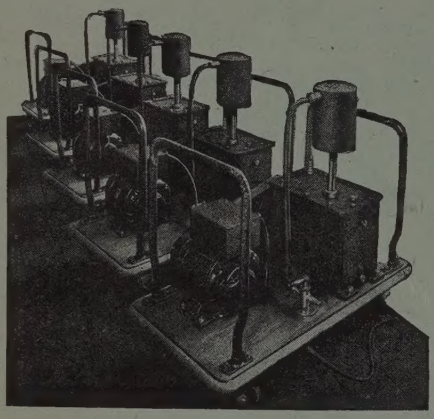

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59.9 : 519.24 : 512.831 *see Abstr.* 18

59.93 : 535.6 *see Abstr.* 190

.015 : 519.24 1

The factorial analysis of multiple-item tests. LAWley, D. N. *Proc. Roy. Soc. Edinb. A*, 62, 1, *pp.* 74–82, 944.—The expected score of an individual on a test consisting of a large number of items is assumed to be given by a formula involving the ability of the individual and also 2 quantities (constant for the test) related to the difficulty of the item and to its power of discrimination between individuals of high and low ability. The method of a preceding paper [Abstr. 43 (1943)] is extended to problems in which more than 1 test is concerned and where the tests are measuring different abilities. An expression for the covariance between 2 such tests is derived. If a factorial analysis is performed on a set of tests of unequal difficulty, using the matrix of variances and covariances, a spurious factor tends to be introduced depending mainly on the differences in difficulty. The effect of this is removed by transforming the variances and covariances to a new set of coefficients. A numerical example is given. L. S. G.

11.2 : 512.895.2 : 513.216 *see Abstr.* 24

11.2 : 517.1 2

A result in a divisor problem. PENG, H. Y. *Sci. Rec., Acad. Sinica*, 1, 1–2, *pp.* 69–72, *Aug.*, 1942.—Let x be a positive integer, $x > 0$ and

$$\tau(x) = \sum_{n \leqslant x} (x - n) \sum_{d|n} 1/d$$

It was proved by Walfisz that

$$\tau(x) = \pi^2 x^2/12 - \tfrac{1}{2}x \log x - (\gamma - 1 + \log 2\pi)x/2 + R(x)$$

where $R(x) = O(x^{3/10})$. A proof is now given of the result $R(x) = O(x^{2/7} \log x)$. L. S. G.

11.221 : 517.1 3

An analogue of Tarry's problem. HUA, L. K., AND MIN, S. H. *Sci. Rec., Acad. Sinica*, 1, 1–2, *pp.* 26–29, *Aug.*, 1942.—An asymptotic formula is derived for the number of solutions of the system of congruences, $x_1^h + \ldots + x_s^h \equiv y_1^h + \ldots + y_s^h$, $1 \leqslant h \leqslant k \pmod{p^l}$ where $p(> k)$ is prime, all the letters denote integers and $s \geqslant k \geqslant 2, l \geqslant k^2$. The number of solutions is $p^{ls-kl}S$ where

$$S = \sum_{a_k=1}^{p^l} \ldots \sum_{a_1=1}^{p^l} \Big| \sum_{x=1}^{p^l} \exp\{2\pi i(a_k x^k + \ldots + a_1 x)/p^l\}\Big|^{2s}$$

and an estimation is made of the sum S. L. S. G.

11.26 : 511.3 : 511.6 4

On character sums. HUA, L. K. *Sci. Rec., Acad. Sinica*, 1, 1–2, *pp.* 21–23, *Aug.*, 1942.—A proof is given of the theorem: Let $k > 1$ be an integer. For each non-principal proper character $\chi(n)$, mod k, we have

$$\Big|\sum_{a=o}^{A} \sum_{n=-a}^{a} \chi(n)\Big| \leqslant (A^* + 1)\sqrt{k}$$

where A^* is the least positive integer such that $1^* \equiv A \pmod{k}$. This theorem has many applications, e.g. to the distribution of primitive roots, mod p (p is prime), the distribution of the nth non-residues, mod p, the upper bound of the fundamental unit in a quadratic field and the Euclidean algorithm in quadratic fields. The following results are announced (no proofs given): If the least primitive root, mod p, is r, then

$$r < \begin{cases} 2^m\sqrt{p} & \text{when } p \equiv 1 \pmod 4 \\ 2^{m+1}\sqrt{p} & \text{when } p \equiv 3 \pmod 4 \end{cases}$$

where m is the number of different prime divisors of $p - 1$. For $p \equiv 17 \pmod{24}$ there is no Euclidean algorithm in the quadratic field $R(\sqrt{p})$ except $p = 17$, 41, 89, 113 and 137. It is known that for $p = 17$, 41 the fields $R(\sqrt{p})$ are Euclidean, so that only doubtful cases are $p = 89$, 113 and 137. Schur's upper bound for the fundamental unit in a quadratic field $R(\sqrt{d})$ where d is positive is improved. L. S. G.

511.28 : 519.48 5

On a double exponential sum. HUA, L. K., AND MIN, S. H. *Sci. Rec., Acad. Sinica*, 1, 1–2, *pp.* 23–25, *Aug.*, 1942.—Let K be a finite field with p^m elements where p is prime and m is a positive integer, and let $T[a]$ denote the trace of an element a in K. A proof is given of the theorem: If $f(x, y)$ is a polynomial of degree $n \geqslant 4$ which is not expressible in terms of a single variable, then

$$\sum_{\xi,\,\eta} \exp\,(2\pi i T[f(\xi, \eta)]/p) = O\Big(p^{m\left(2-\frac{2}{n}\right)}\Big)$$

where ξ, η run independently over all elements of K. By taking K to be the field of residue classes, mod p, we obtain

$$\sum_{\xi=1}^{p} \sum_{\eta=1}^{p} \exp\,(2\pi i f(\xi, \eta)/p) = O\Big(p^{2-\frac{2}{n}}\Big)$$

which is a 2-dimensional analogue of a theorem due to Mordell. L. S. G.

511.284.1 = 397 6

A variant of the sieve of Eratosthenes. BENCKERT, C. R. *Ark. Mat. Astr. Fys.*, 29 *B*, 4, *No.* 13, 5 *pp.*, 1943.—To determine the prime numbers of the form $4\mu - 1$ we form a table as follows:

		1 (5)	2 (9)	3 (13)	4 (17)	...	β ($4\beta+1$)	...
1	(3)	4	7	10	13	...	$3\beta+1$	...
2	(7)	9	16	23	30	...	$7\beta+2$	...
3	(11)	14	25	36	47	...	$11\beta+3$	...
4	(15)	19	34	49	64	...	$15\beta+4$	...
⋮	⋮	⋮	⋮	⋮	⋮			
α	($4\alpha-1$)	$5\alpha-1$	$9\alpha-2$	$13\alpha-3$	$17\alpha-4$	...	μ	...
⋮	⋮	⋮	⋮	⋮	⋮			

Here the entry (μ) in the (α, β)th place is given by $4\mu - 1 = (4\alpha - 1)(4\beta + 1)$. The numbers not appearing, viz. 1, 2, 3, 5, 6, 8, 11 . . . yield the required primes, 3, 7, 11, 19, 23, 31, 43. . . . A similar process is applicable to primes of other forms, e.g. $6\mu - 1$ and $12\mu - 1$. L. S. G.

511.29 7

Some applications of Ramanujan's trigonometrical sum $C_m(n)$. RAMANATHAN, K. G. *Proc. Indian Acad. Sci. A*, 20, *pp.* 62–69, *July*, 1944.—The sum $C_m(n)$ is applied to 2 arithmetical theories, the theory of relative partitions (mod m) and the theory of class division of the integers (mod m). If $n \equiv l_1 + l_2 + \ldots \pmod m$, n is said to be relatively partitioned (mod m), and in the class division of the integers (mod m) we divide the integers into a certain number of classes C_1, C_2, . . .

according to their g.c.d. with m. The classes C_1, C_2, . . . form a linear associative algebra with the multiplication table $C_iC_j = \sum_k \gamma_{ij}^k C_k$. It is shown that γ_{ij}^k is expressible in terms of Ramanujan's sum.

L. S. G.

511.3 : 511.6 : 511.26 *see Abstr.* 4

511.32 8

On some formulae in analytical theory of numbers. BANERJEE, D. P. *Bull. Calcutta Math. Soc.*, 36, *pp.* 49–50, *March*, 1944.—The formulae relate to the arithmetical function $d(n)$ of the integer n. L. S. G.

511.46 9

On the decomposition of quadratic forms in seven variables. KO, C. *Sci. Rec., Acad. Sinica*, 1, 1–2, *pp.* 30–33, *Aug.*, 1942.—The positive definite form $\sum_{i,j=1}^{n} a_{ij}x_ix_j$ ($a_{ij} = a_{ji}$ being integers) with determinant $D_n = |a_{ij}| \neq 0$ is decomposable if it is the sum of two non-negative forms with integer coefficients. It is proved that, when $n = 7$, the only non-decomposable form with $D_7 > 0$ is

$$\sum_1^7 x_i^2 + \left(\sum_1^7 x_i\right)^2 - 2x_1x_2 - 2x_2x_7$$

which had previously been proved non-decomposable by Mordell. L. S. G.

511.46 10

On the decomposition of quadratic forms in eight variables. KO, C. *Sci. Rec., Acad. Sinica*, 1, 1–2, *pp.* 33–36, *Aug.*, 1942.—It is proved that if a positive definite quadratic form in eight variables, with integer coefficients, is not equivalent to

$$\sum_{i=1}^8 x_i^2 + \left(\sum_{i=1}^8 x_i\right)^2 - 2x_1x_2 - 2x_2x_8$$

then it can be decomposed into a sum of a linear square and a non-negative quadratic form, both with integer coefficients. [See Abstr. 9 (1945)]. L. S. G.

511.53 = 3 11

On some arctan-equations leading to interesting indeterminate equations. LJUNGGREN, W. *Ark. Mat. Astr. Fys.*, 29*A*, 2, *No.* 13, 11 *pp.*, 1943.—Some equations considered by Störmer are generalized. It is shown that the indeterminate equation

$$m\tan^{-1}(\sqrt{3}/x) + n\tan^{-1}(\sqrt{3}/y) = k\pi/6$$

has only 14 solutions, in integers m, n, x, y, k given in the following table.

m	1	-1	1	1	1	2	2	2	2	2	3	3	3	3
n	1	-1	1	1	1	-1	1	-1	1	1	-1	-1	-1	2
x	2	2	4	5	6	2	5	9	6	7	5	2	9	12
y	5	9	15	9	7	12	12	12	45	45	37	37	37	37
k	2	1	1	1	1	3	1	1	1	1	2	4	1	1

The equation

$$m\tan^{-1}(\sqrt{2}/x) + n\tan^{-1}(\sqrt{2}/y) = k\pi/2$$

has only 10 solutions as follows:

m	1	2	2	3	3	3	5	5	5	5
n	1	-1	1	1	-1	2	-1	1	-2	3
x	1	1	2	1	2	4	1	2	4	5
y	2	4	4	5	5	5	22	22	22	22
k	1	1	1	2	1	1	3	2	1	1

L. S. G.

511.6 : 511.3 : 511.26 *see Abstr.* 4

511.6 : 512.312 = 3

A representation of the irreducible polynomials imaginary quadratic number fields. PETTERSON, E. *Ark. Mat. Astr. Fys.*, 29*A*, 2, *No.* 15, 11 *pp.*, 1943.— A development of the theory of criteria of irreducibility. The main theorem proved is: Every normalized irreducible integral polynomial $f(x)$ of an imaginary quadratic number field K has an infinitely many-valued representation, $f(x) = h(x) + g(x)$, where the polynomials $h(x)$ and $g(x)$ are factor-free, integral in K and satisfy grad $h(x)$ = grad $g(x) + 1$, $|h(x)| < 1$ for $|g(x)| = 1$. L. S.

512 : 519.5 : 530.1

The new algebras and their significance for physics and philosophy. WHITTAKER, E. T. *Phil. Mag.*, 3 *pp.* 1–15, *Jan.*, 1944.—[See Abstr. 3 (1944)].

512.312 : 511.6 = 3 *see Abstr.* 12

512.34

An improvement on the G.C.D. method for comple roots. HITCHCOCK, F. L. *J. Math. Phys.*, 23, *pp.* 6 74, *May*, 1944.—If the equation to be solved $P(x) = \sum_{i=0}^{n} a_i x^i = 0$, where $a_n = 1$ and $a_0, \ldots, a_{n-}$ are real, and if $Q = x^2 + \lambda x + \mu$ is an approxima quadratic factor of $P(x)$, an improvement may b obtained as follows. Let $P(x)$ on division by Q yie a quotient $R(x)$ and a remainder $r_1x + r_0$. L $R(x)$ on division by Q yield a remainder $s_1x + s$ Compute the two quantities $t_1 = s_0 - \lambda s_1$, $t_0 = -\mu$ and then $\lambda' = (r_1s_0 - r_0s_1)/\Delta$, $\mu' = (r_0t_1 - r_1t_0)/$ where $\Delta = t_1s_0 - t_0s_1$. Then a better approximatio to the factor Q is $Q' = x^2 + (\lambda + \lambda')x + \mu + \mu$ The process may be repeated and all the steps a easily carried out on a computing machine. Th theory of the method is given, including a process f finding Q roughly. Examples are given and t method is compared with others. [Abstr. 2235, 22 (1941), 2647 (1943)]. L. S.

512.52

Table of coefficients for inverse interpolation wi advancing differences. SALZER, H. E. *J. Math. Phy* 23, *pp.* 75–102, *May*, 1944.—A supplement to previous table [Abstr. 1505 (1944)]. Write $x = x_0 + ph$; $m = \{f(x) - f(x_0)\}/\Delta$, where $\Delta = f(x_0 + h) - f(x_0)$. The problem is to find p when x_0, h and t value of $f(x)$ are given. Let $\Delta_x^1 = f(x + h) - f($ and $\Delta_x^r = \Delta_{x+h}^{r-1} - \Delta_x^{r-1}$. Then $p = m + m(1-$ $\Delta^2/2\Delta + m(1-m)(m-2)\Delta^3/6\Delta + A(m)(\Delta^2/\Delta)^2$ $B(m)\Delta^4/\Delta$ + 5th order terms + ... Tables $A(m)$ and $B(m)$ are given for the range 0·000 (0·00 1·000 for m, and for the same range, tables are giv of the coefficients of 5th-order terms. For the 6t order terms, the coefficients are given over the ran 0·00 (0·01) 1·00 for m, and short tables are al given for 7th- and 8th-order terms. L. S.

512.831

On matrices whose association matrices are equ YEN, C. T. *Sci. Rec., Acad. Sinica*, 1, 1– *pp.* 87–90, *Aug.*, 1942.—A proof is given of t theorem: Let $T(\mathbf{A})$ be a non-singular irreducible ass ciated matrix of $\mathbf{A}$. If the index of $T(\mathbf{A})$ is $r <$ and if one of the matrices $\mathbf{A}$, $\mathbf{B}$ is non-singular, th the relation $T(\mathbf{A}) = T(\mathbf{B})$ holds only when $\omega\mathbf{A} =$ where ω is an rth root of unity. L. S.

2.831 : 513.77 17

On plane factorizations of pseudo-Euclidean rotations. LEE, H. C. *Quart. J. Math.*, 15, *pp.* 7–10, *March–June*, 1944.—A rotation of the Euclidean space R_n is called a plane rotation if it leaves unaltered $n - 2$ of the variables $x_1, \ldots, x_n$. Such a rotation of the form

$$\begin{pmatrix} y_i \\ y_j \end{pmatrix} = \mathbf{M}\begin{pmatrix} x_i \\ x_j \end{pmatrix}, \quad y_k = x_k (k \neq i, j)$$

d is called an ordinary or pseudo rotation according as

$$\mathbf{M} = \begin{pmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{pmatrix} \quad \text{or} \quad \mathbf{M} = \begin{pmatrix} \cosh\theta & \sinh\theta \\ \sinh\theta & \cosh\theta \end{pmatrix}$$

very rotation in R_n can be factorized into a product plane rotations, and this theorem is extended to a eudo-Euclidean space R_n^*, where the fundamental rm (of index p) is taken to be $x_1^2 + \ldots + x_p^2 - {}_{p+1} - \ldots - x_n^2$. Orthogonal transformations (forming a group) have matrices $\mathbf{A}$ such that $\mathbf{A}^*\mathbf{G}\mathbf{A} = \mathbf{G}$ here $\mathbf{G} = \begin{pmatrix} \mathbf{E}_p & 0 \\ 0 & -\mathbf{E}_{n-p} \end{pmatrix}$, $\mathbf{E}_r$ denoting the unit atrix of order r. The theorem proved is: Every otation of R_n^* can be factorized into $\frac{1}{2}n(n-1)$ plane otations of which the number of pseudo-members is in $(p, n-p)$. L. S. G.

12.831 : 519.24 : 159.9 18

The matrices of factor analysis. ALBERT, A. A. *roc. Nat. Acad. Sci., Wash.*, 30, *pp.* 90–95, *April*, 944.—A general problem arising in factor analysis psychological tests) is to find a diagonal matrix $\mathbf{D}$ uch that $\mathbf{M} = \mathbf{M}_0 + \mathbf{D}$ has min. rank ρ, where $\mathbf{M}_0$ a given n-rowed symmetric matrix with zero diagonal ements and correlation coefficients $a_{ij} (0 < a_{ij} < 1)$ r the non-diagonal elements. The solution is given the case where ρ equals the ideal rank which is the rgest order of a non-vanishing minor of $\mathbf{M}_0$ obtained y a selection of r rows and r different columns. A mputational procedure is outlined and a numerical xample is given. L. S. G.

12.831 : 519.272 19

Graphical method of factoring the correlation matrix. HURSTONE, L. L. *Proc. Nat. Acad. Sci., Wash.*, 30, *p.* 129–134, *June*, 1944.—The correlation matrix $\mathbf{R}$ is ymmetric and of order n and rank r. The factor atrix $\mathbf{F}$ is an $n \times r$ matrix such that $\mathbf{F}\mathbf{F}' = \mathbf{R}$. A ethod for finding $\mathbf{F}$ (not unique) is given and there s a numerical illustration. The matrix $\mathbf{R}$ arises in sychological problems involving multiple factor nalysis. L. S. G.

12.831 : 519.272 20

The minimum rank of a correlation matrix. ALBERT, . A. *Proc. Nat. Acad. Sci., Wash.*, 30, *pp.* 144–146, *une*, 1944.—The correlation matrix $\mathbf{R}$ (symmetric) as prescribed non-diagonal elements and the problem s to determine the diagonal elements a_{ii} so that the esulting $\mathbf{R}$ has min. rank ρ. If r is the ideal rank of $\mathbf{R}$ Abstr. 18 (1945)] (so that $\rho \geqslant r$), $\mathbf{R}$ may be written in he form

$$\mathbf{R} = \begin{pmatrix} \mathbf{A} & \mathbf{B}' & \mathbf{G}' \\ \mathbf{B} & \mathbf{C} & \mathbf{H}' \\ \mathbf{G} & \mathbf{H} & \mathbf{K} \end{pmatrix}$$

where $\mathbf{A}$, $\mathbf{B}$, $\mathbf{C}$ are square matrices of order r and $\mathbf{B}| \neq 0$. A proof is given of the theorem: Let the ideal rank r of $\mathbf{R}$ be also the rank of $\mathbf{G}$ and $\mathbf{H}$. Then there exist unique diagonal elements a_{ii} such that the resulting correlation matrix $\mathbf{R}$ has a rank r. L. S. G.

512.895.2 : 511.2 : 513.216 *see Abstr.* 24

512.897.6 21

Table of primitive positive quaternary quadratic forms with determinant $\leqslant 25$. KO, C., AND WANG, S. C. *Sci. Rec., Acad. Sinica*, 1, 1–2, *pp.* 54–58, *Aug.*, 1942.—The coefficients of the forms are listed and a table is given of the class numbers. L. S. G.

513.0 : 530.12 22

The concept of space in mathematics and natural philosophy. SEN, N. R. *Bull. Calcutta Math. Soc.*, 36, *pp.* 1–6, *March*, 1944.—A brief review of the historical development of the concept of space. The abstract nature of space in mathematics is emphasized and the relative nature of time and physical space (leading to relativity theory) is discussed. L. S. G.

513.01 = 4 23

On the geometry of spheres and circles, and the definition of the plane and the straight line. ROSSIER, P. *Arch. Sci. Phys. Nat.*, 25, *Sept.–Dec.* (*Suppl. No.* 3, *C.R. Soc. Phys. Hist. Nat. Genève*, 60, 3, *pp.* 284–286), 1943.—The conditions are analytically examined under which an elementary geometry can be established, based on the sphere and the circle rather than on the plane and the str. line. A. HU.

513.216 : 511.2 : 512.895.2 24

On some problems of the geometrical theory of numbers. HUA, L. K. *Sci. Rec., Acad. Sinica*, 1, 1–2, *pp.* 19–21, *Aug.*, 1942.—Some improvements are announced (no proofs are given) in estimations of $R(x)$ and $Q(x)$, the numbers of lattice points in the circle $u^2 + v^2 \leqslant x^2$ and the sphere $u^2 + v^2 + \omega^2 \leqslant x^2$, respectively. These are better than the results of Titchmarsh and Vinogradow. The following result is obtained: a ternary cubic form is factorable into 3 linearly independent factors if and only if the ratio of the form to its Hessian is constant. L. S. G.

513.561 25

On the harmonic locus of two given quadrics. CHARIAR, V. R. *Bull. Calcutta Math. Soc.*, 36, *pp.* 41–44, *March*, 1944.—It is shown that the harmonic transversals of the 2 quadrics through a point P generate a quadric cone. This breaks up into a pair of planes if P lies on the quartic surface which is obtained by applying the transformation $x = X^2$, $y = Y^2$, $z = Z^2$, $t = T^2$ to the quadric surface touching the faces of the fundamental tetrahedron. The following result is also deduced: the harmonic transversals which meet 2 given curves, σ and τ, of degrees m and n, generate a surface F of degree $4mn$. The curves σ and τ are singular curves of F of multiplicity $2n$ and $2m$ respectively. The locus of lines cutting 3 given quadrics in involution is also discussed. L. S. G.

513.578.7 : 513.735.8 26

An analogue of the Darboux pencil of quadrics. PA, C. K. *Sci. Rec., Acad. Sinica*, 1, 1–2, *pp.* 65–69, *Aug.*, 1942.—The pencil, defined at a generic point P of a non-ruled surface in ordinary space, is a certain subsystem of the ∞^4 quadrics through the two asymptotic tangents to the surface at P. Various properties of the pencil are discussed, e.g. by means of one of these quadrics and any quadric of Darboux,

D_h, a simple geometric construction is given for the second directrix of Wilczynski. A construction is also given for the projective normal of Fubini. L. S. G.

513.614.1 : 513.624.9 *see Abstr.* 30

513.615 27

On a theorem on the plane cubic. RAO, C. V. H. *Bull. Calcutta Math. Soc.*, 36, *pp.* 7–8, *March*, 1944.—A synthetic (geometric) proof is given of the theorem that if a line varies so that the pairs of its common points with 3 given conics belong to an involution then the line envelops a curve of class 3. L. S. G.

513.615.65 : 513.623.6 28

Rational points on cubic curves and surfaces. MORDELL, L. J. *Amer. Math. Mon.*, 51, 6, *pp.* 332–339, *June–July*, 1944.—A review of known results, some of which have recently been obtained by the author. There is a discussion of the rational points on (i) plane cubic curves (including Poincaré's finite basis theorem) and (ii) cubic surfaces. An outline of recent work by Richmond, Segre and the author is given. [Abstr. 1925, 1928, 2521 (1944)]. L. S. G.

513.616 29

The identification of Klein's quartic. EDGE, W. L. *Proc. Roy. Soc. Edinb. A*, 62, 1, *pp.* 83–91, 1944.—The binary quartic $\phi(x_1, x_2) = ax_1^4 + 4bx_1^3x_2 + 6cx_1^2x_2^2 + 4dx_1x_2^3 + ex_2^4$ may be written in the matrix form $\phi = x^{[2]}\mu x^{[2]}$, where

$$x^{[2]} = \begin{pmatrix} x_1^2 \\ \tau\, x_1\, x_2 \\ x_2^2 \end{pmatrix} \quad \text{and} \quad \mu = \begin{pmatrix} a & \tau b & c \\ \tau b & 2c & \tau d \\ c & \tau d & e \end{pmatrix}$$

Here $\tau^2 = 2$. It is observed that μ is symmetric and that its central element is double the element in the top right hand and bottom left hand corner. This property is only true for the adjugate matrix of μ if $I \equiv ae - 4bd + 3c^2 = 0$, and this is the condition for ϕ to be equianharmonic. A similar matrix representation is possible for a quartic in any number (n) of variables. When $n = 3$, the quartic may be specialized to the Klein quartic admitting 168 linear self-transformations. This specialization means that 6 relations must be satisfied by the coefficients of the quartic. The geometric interpretation of these is given in terms of a quartic and a Veronese surface and the algebraic interpretation in terms of the adjugate of a matrix analogous to the matrix μ above. Some properties of a Veronese surface are established which are related to known properties of plane quartic curves; and these lead to the consideration of certain hexads of points associated with a Klein curve.

L. S. G.

513.623.6 : 513.615.65 *see Abstr.* 28

513.624.9 : 513.614.1 30

A remark on unicursal curves lying on the general quartic surface. SEGRE, B. *Quart. J. Math.*, 15, *pp.* 24–25, *March–June*, 1944.—The general quartic surface F contains a finite number $c_h > 0$ of unicursal curves of order $4h$ ($h = 1, 2, 3, \ldots$). To prove this it is observed that surfaces of order h cut out on F a linear system $|C|$ of dimension $\binom{h+3}{3} - \binom{h-1}{1} - 1 = 2h^2 + 1$ and degree $4h$. Since F has an effective canonical curve of zero order, $|C|$ is self-adjoint, i.e. its curves cut out canonical sets on the general C, so that C has a genus $2h^2 + 1$. The general C is non-singular so that $2h^2 + 1$ conditions must be imposed in order that it acquire $2h^2 + 1$ double points. Such a C has genus zero i.e. it is unicursal. The numbers c_h are not easy to determine except in the case $h = 1$ when c_1 = number of tritangent planes of $F = 3\,200$. L. S. G.

513.651 3

On the invariants of contact of curves in a projective space of N dimensions and their geometrical interpretation. CHERN, S. S. *Sci. Rec., Acad. Sinica*, 1, 1–2, *pp.* 11–15, *Aug.*, 1942.—A method is given for deriving the invariants and the geometric interpretation generalize earlier results due to B. Segre and C. Segre [See Abstr. 32 (1945)]. L. S. C.

513.651 3

Note on a theorem of B. Segre. SU, B. *Sci. Rec. Acad. Sinica*, 1, 1–2, *pp.* 16–19, *Aug.*, 1942.—Segre has shown that there are $n - 1$ projective contact invariants of 2 curves in $[n]$ having at a common point O all the osculating spaces in common. The result is generalized to the case where the curves have a point and all the relative osculating spaces of order up to and including $k (k \leqslant n)$ in common. It is shown that there are $k - 1$ projective invariants in this case. A geometric interpretation of the invariants is given. L. S. C.

513.71 3

The tensor representation of the figures of Study's "Geometrie der Dynamen." SPENCER, D. E. *Math. Phys.*, 23, *pp.* 103–115, *May*, 1944.—A continuation of a previous paper [Abstr. 1729 (1944)]. A metric tensor $g^{k\lambda}$ is introduced into the affine space and a detailed study is made of the various figures. Various forms for $g^{k\lambda}$ are possible, but the one chosen is the Euclidean metric for which the co-ordinate matrix of $g^{k\lambda}$ has the form

$$\begin{pmatrix} 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

L. S. C.

513.71 : 513.813 3

On the line geometry of the Riemann tensor. RUSE, H. S. *Proc. Roy. Soc. Edinb. A*, 62, 1, *pp.* 64–71, 1944.—The curvature tensor R_{ijkl} in a Riemannian V_n is used to define a quadratic complex of lines in the projective space S_{n-1}, which is the plane at infinity in the tangent space to V_n at a generic point P. Any property of V_n at P which is expressible by algebraic relations amongst the vectors and tensors involved may be described in terms of the geometry of S_{n-1} which is thus of special importance. The complex considered consists of the lines of S_{n-1} satisfying the equation $R_{ijkl}p^{ij}p^{kl} = 0$, where $p^{ij} \equiv Y^iZ^j - Y^jZ^i$, Y^i and Z^i being any 2 points of S_{n-1}, and a study of this complex is made in relation to the fundamental quadric, $g_{ij}X^iX^j = 0$, where g_{ij} is the fundamental tensor of V_n at the point P. A brief account is given of the theory for the case $n = 3$ and an introduction to the case $n = 4$. L. S. C.

513.733.4 3

On the curvature form and the projective curvature of a space curve. HSIUNG, C. C. *Sci. Rec., Acad. Sinica*, 1, 1–2, *pp.* 72–74, *Aug.*, 1942.—A geometric

aracterization is given of the curvature form and of e 1st and 2nd projective curvatures of a curve in]. The method may be extended to curves in [4]. L. S. G.

3.734 36

Some theorems on ruled surfaces. CHANG, S. C. *i. Rec., Acad. Sinica*, 1, 1–2, *pp.* 75–77, *Aug.*, 42.—Proofs are given of the following theorems:) 2 consecutive osculating quadrics along a genera- r g of a ruled surface R have, besides g, 2 common nerators g_1 and g_2. When g varies on R, these nstitute ruled surfaces R_1 and R_2 such that g_1, g_2 id their consecutive generators on R_1 and R_2 lie one and the same quadric. (2) If the generators 2 ruled surfaces R_1 and R_2 are in such a corre- ondence that 2 consecutive generators of R_1 and eir corresponding consecutive generators of R_2 lie a quadric $\bar{Q}$ then the 2 ruled surfaces constituted the common generators, other than those on R_1 id R_2, of 2 consecutive quadrics $\bar{Q}$ are in the same rrespondence. From these a sequence of quadrics obtained associated with a generator of a ruled rface, and an application is made to the surface nerated by the asymptotic tangents of one system a surface along a curve on it. A new definition is tained of the sequence of quadrics obtained by odeaux. L. S. G.

3.735.8 37

Contribution to the projective differential geometry a surface. HSIUNG, C. C. *Sci. Rec., Acad. Sinica*, 1–2, *pp.* 62–65, *Aug.*, 1942.—Denote by u and v the ymptotic tangents at a generic point P of a surface in ordinary space. By Σ_u we denote the ruled rface of the v-tangents constructed at the points the asymptotic curve u through P. The surface Σ_v is similarly defined. The paper consists of a mber of applications of the surfaces Σ_u and Σ_v. L. S. G.

3.735.8 : 513.578.7 *see Abstr.* 26

3.736.51 38

On the projective linear element of a non-holonomic rface. WANG, H. C. *Sci. Rec., Acad. Sinica*, 1, 2, *pp.* 84–86, *Aug.*, 1942.—The projective linear ement is the quotient of the product of 2 quadratic fferential forms by the square of a Pfaffian form. has the fundamental property that 2 non-holonomic rfaces are projectively equivalent (i.e. one surface n be transformed into the other by a collineation or rrelation) when and only when they have the same ojective linear element. L. S. G.

3.742 39

Properties of certain cubic primals. SEMPLE, J. G. *uart. J. Math.*, 15, *pp.* 26–33, *March–June*, 1944.—A idy is made of the geometry of the determinantal bic primal $D_7^3 = (|3, 3|, [8])$, given by $|x_{ij}| = 0$ $(i, j = 1, 2, 3)$, and its double locus $D^{(1)} = (|3, 3|_2, [8])$ hich is of dimension 4 and order 6. Veneroni's ial V_4^3, a special type of determinantal cubic primal [5], is also studied. It is a section of D_7^3 by a [5] tisfying a certain condition [see Abstr. 779 (1944)]. L. S. G.

3.761.1 : 513.81 40

Projectivities on a line and non-Euclidean motions space. WU, T. J. *Sci. Rec., Acad. Sinica*, 1, 1–2, *pp.* 59–61, *Aug.*, 1942.—A projectivity on a line l is given by $\rho x_1^* = \xi_1 x_1 + \xi_2 x_2$; $\rho x_2^* = \xi_3 x_1 + \xi_4 x_2$. If $(\xi_1, \ldots, \xi_4)$ are homogeneous co-ordinates in a [3], S, we obtain Stephanos (1, 1) correspondence between projectivities on l and points of S. The singular projectivities are represented by the points of the quadric $\Delta \equiv \xi_1\xi_4 - \xi_2\xi_3 = 0$. This representation is used to study collineations in S which leave Δ invariant. Two projectivities on l are conjugate if their respective points of S are conjugate with regard to Δ. Some theorems are proved concerning such projectivities. A theory is outlined of the motions in an elliptic space which leave Δ invariant. L. S. G.

513.77 : 512.831 *see Abstr.* 17

513.77 : 517.63 *see Abstr.* 57

513.81 : 513.761.1 *see Abstr.* 40

513.813 : 513.71 *see Abstr.* 34

513.814 41

On a Weyl geometry defined from an $(n-1)$-parameter family of hypersurfaces in a space of n dimensions. CHERN, S. S. *Sci. Rec., Acad. Sinica*, 1, 1–2, *pp.* 7–10, *Aug.*, 1942.—A generalized Cartan space of dimension n is a number space with a space of Klein attached to each point and with an infinitesimal transformation of a given Lie group G which allows a mapping of the Klein spaces attached to two neighbouring points on each other. When G is the group of similarity transformations we have a Weyl geometry. It is proved that the geometry of a space of $n(\geqslant 3)$ dimensions with an $(n-1)$-parameter family of hypersurfaces is a Weyl geometry. L. S. G.

513.814 42

On unitary geometry. LEE, H. C. *Sci. Rec., Acad. Sinica*, 1, 1–2, *pp.* 49–54, *Aug.*, 1942.—Let $z_1, \ldots, z_n$ be n independent complex variables. An analytic function of these variables and of their complex conjugates $\bar{z}_1, \ldots, \bar{z}_n$ is said to be semi-analytic. It is proved that the fundamental tensor of every symmetric unitary space is of the form $a_{ij} = \partial_i\partial_j H(z, \bar{z})$ where H is a real semi-analytic function determined to within a transformation $H \to H + F(z) + \bar{F}(\bar{z})$. Here $\partial_i \equiv \partial/\partial z_i$ and H is called the generating function of the space. For unitary spaces which are flat or of constant curvature (α), H is determined. In the first case it is a non-singular Hermitian form and in the second case $H = -\frac{2}{\alpha}\log\mu$ where μ is a non-homogeneous Hermitian form with non-vanishing discriminant and is determined, except for a transformation of the form $\mu \to G(z)\bar{G}(\bar{z})\mu$. L. S. G.

513.821 = 6 43

The S_3's which are osculatory to the curves of a variety and a new characterization of a class of varieties. TERRACINI, A. *Rev. Univ. Nac. Tucumán*, 3, *pp.* 317–339, *Dec.*, 1942.—The Veronese surface of [5] is the only non-conical surface of $[r](r \geqslant 5)$ the chords of which generate a variety of only 4 dimensions and whose tangent planes meet two by two. In the present paper these properties are generalized to varieties defined previously. L. S. G.

513.83 44

The localization theory in set-topology. VAIDYANATHASWAMY, R. *Proc. Indian Acad. Sci.A*, 20, *pp.* 51–61, *July*, 1944.—A review of the localization theory and a study of the properties of compact and supercompact ideals (these are defined). Certain extensions of an ideal are also studied. L. S. G.

517.1 : 511.2 *see Abstr.* 2

517.1 : 511.221 *see Abstr.* 3

517.3 : 517.5 = 3 45

A problem of moments. KJELLBERG, B. *Ark. Mat. Astr. Fys.*, 29*A*, *No.* 2, 33 *pp.*, 1943.—The inequality

$$\frac{1}{\sqrt{(2\pi)}}\int_{-\infty}^{\infty}|f(x)|dx \leqslant \left[\int_{-\infty}^{\infty}|g(t)|^2dt \,.\, \int_{-\infty}^{\infty}|g'(t)|^2dt\right]^{1/4}$$

where $f(x)$ and $g(t)$ are Fourier transforms, i.e.

$$g(t) = \frac{1}{\sqrt{(2\pi)}}\int_{-\infty}^{\infty} e^{itx}f(x)dx$$

leads, upon using the Parseval formulae, to the result

$$\frac{1}{\sqrt{(2\pi)}}\int_{-\infty}^{\infty}|f(x)|dx \leqslant \left[\int_{-\infty}^{\infty}|f(x)|^2dx \,.\, \int_{-\infty}^{\infty}x^2|f(x)|^2dx\right]^{1/4}.$$

This means that the integral of the abs. value of $f(x)$ is finite if the two moments, $\int_{-\infty}^{\infty}x^{2\alpha}|f(x)|^2dx$, of $|f|^2$ given by $\alpha = 0, 1$ are finite. This result is generalized to functions of several variables. If

$$M_j^2 = \int_{-\infty}^{\infty}\cdots\int_{-\infty}^{\infty}|f(x_1, \ldots, x_n)|^2x_1^{2\alpha_{j1}}x_2^{2\alpha_{j2}}\cdots x_n^{2\alpha_{jn}}dx_1\ldots dx_n (j = 1, \ldots, p)$$

conditions are found in order that the result $\sum_{j=1}^{p}M_j^2 < \infty$ implies

$$E = \int_{-\infty}^{\infty}\cdots\int_{-\infty}^{\infty}|f(x_1, \ldots, x_n)|dx_1\ldots dx_n < \infty.$$

The upper limit of E as a function of the moments M_j^2 is also found. The inequalities of Schwarz and Hölder and generalizations of these are interpreted geometrically. L. S. G.

517.5 : 517.3 = 3 *see Abstr.* 45

517.512.2 46

On the convergence of the conjugate series of a Fourier series. CHEN, K. K. *Sci. Rec., Acad. Sinica*, 1, 1–2, *pp.* 1–6, *Aug.*, 1942.—Let

$$F = \sum_{n=1}^{\infty}(a_n \sin nx - b_n \cos nx)$$

be the conjugate series of the Fourier series of $f(x)$ and write $\psi(t) = f(x + t) - f(x - t)$. The criterion of Misra and Zygmund for the convergence of F is extended to the following: If $\Psi(t) = \int_0^t\psi(t)dt = O(t)$ and $\lim_{\mu\to\infty}\overline{\lim_{\varepsilon\to+0}}\int_{\mu\varepsilon}^{\pi}|\psi(t+\varepsilon) - \psi(t)|\frac{dt}{t} \neq 0$ then F converges to $\frac{1}{2\pi}\int_0^{\pi}\psi(t)\cot\frac{1}{2}tdt$ when and only when the latter exists. L. S. G.

517.512.2 4

Note on strong summability of Fourier series. LOO, C. T. *Sci. Rec., Acad. Sinica*, 1, 1–2, *pp.* 78–83, *Aug.*, 1942.—If $S_n(x)$ $(n = 0, 1, 2, \ldots)$ are the partial sums of the Fourier Series of the L-integrable function $f(x)$ [Abstr. 1938 (1944)], a result due to Hardy and Littlewood states that $\sum_{\nu=0}^{n}|S_\nu(x) - f(x)|^2 = O(n\log n)$ almost everywhere. A result analogous to this is shown to be true for certain special lacunary partial sums. L. S. G.

517.512.2 4

On strong summability of Fourier series. CHENG, M. T. *Sci. Rec., Acad. Sinica*, 1, 1–2, *pp.* 91–97, *Aug.*, 1942.—Let $S_n(t) = \frac{1}{2}a_0 + \sum_{\nu=1}^{n}(a_\nu\cos\nu t + b_\nu\sin\nu t)$ $(n = 0, 1, 2, \ldots)$ be the partial sums of the Fourier series of a periodic function $f(t)$, integrable in the sense of Lebesgue in $(-\pi, \pi)$. Write $\phi_x(t) = \frac{1}{2}[f(x + t) + f(x - t) - 2f(x)]$. A proof is given of the following theorem: If

$$\phi_1(t) = \int_0^t\phi_x(u)du = o(t), \quad \int_0^t|\phi_x(u)|du = O(t)$$

then $\sum_{\nu=0}^{n}|S_\nu(x) - f(x)|^4 = 0[n(\log n)^3]$

L. S. G.

517.512.71 : 517.941.92 4

An extension of the Sturm-Liouville expansion. TITCHMARSH, E. C. *Quart. J. Math.*, 15, *pp.* 40–47, *March–June*, 1944.—The linear matrix operator $\begin{pmatrix} p(x) & , q(x)+\frac{d}{dx} \\ q(x)-\frac{d}{dx}, & r(x)\end{pmatrix}$ is denoted by $\mathbf{L}$ and $\mathbf{f} = \begin{pmatrix} f_1 \\ f_2\end{pmatrix}$ is a function with two components. The matrix equation $(\mathbf{L} - \omega)\mathbf{f} = 0$ is equivalent to the differential equations $f_2' + pf_1 + qf_2 - \omega f_1 = -f_1' + qf_1 + rf_2 - \omega f_2 = 0$, and the linear operator yields a formula for the expansion of an arbitary function in terms of eigenfunctions. The case is considered where x lies in a finite interval (a, b) and $p(x)$, $q(x)$, $r(x)$ and their first derivatives are continuous. It is shown that in this case the expansion converges under practically the same conditions as those of Fourier series. The expansion is first obtained and then the orthogonal property is established. L. S.

517.521.2

Some remarks on oscillating series. WANG, F. T. *Quart. J. Math.*, 15, *pp.* 1–6, *March–June*, 1944.—Let

$$\sigma_n^r = \left\{1\Big/\binom{n+r}{n}\right\}\sum_{\nu=0}^{n}\binom{n-\nu+r}{n-\nu}a_\nu$$

be the nth Cesàro mean of order r of the series $a_0 + a_1 + \ldots$ A recent theorem of Boas is extended into the following. If r is a positive integer, $0 < \delta < 1$, and

(i) $\sigma_n^r - s = o\{n^{r(\delta-1)}\}$ $(n \to \infty)$

(ii) $a_n > -Kn^{-\delta}$

then $\sum a_n$ is convergent to sum s. It is shown by means of examples taken from the theory of Fourier series, that this is a "best possible" result. T

precise theorem is: If $0 < \delta < \delta' < 1/r$, there exists a divergent series $\sum a_n$ such that

(i) $a_n = O(n^{-\delta})$
(ii) $\sigma_n^r = o\{n^{r(\delta'-1)}\}$ as $n \to \infty$

L. S. G.

517.522 : 517.53 : 517.948 51

Functional equations and self-reciprocal functions connected with Lambert series. GUINAND, A. P. *Quart. J. Math.*, 15, *pp.* 11–23, *March–June*, 1944.—The Lambert series considered is

$$\psi(z) = \sum_{n=1}^{\infty} \frac{1}{e^{2\pi nz} - 1} = \sum_{m=1}^{\infty} \sum_{n=1}^{\infty} e^{-2\pi mnz} = \sum_{n=1}^{\infty} d(n) e^{-2\pi nz}$$

where $d(n)$ is the number of divisors of n. If $\psi(z) = \phi(z) + \frac{1}{2\pi z}(\gamma - \log 2\pi z)$, it is shown that, when $z(= x)$ is real and positive, $F(x)$ is self-reciprocal w.r.t. to the Fourier kernel

$$\frac{2x}{\pi(x^2 - 1)}, \text{ i.e. } F(x) = \frac{2}{\pi} P \int_0^{\infty} \frac{xt}{x^2 t^2 - 1} F(t)\,dt$$

and that when z is complex, the functions $\psi(z) + \frac{i}{z}F(1/z)$, $F(z) - \frac{i}{z}F(1/z)$, can be continued analytically for $R(z) < 0$. $F(z)$ is shown to satisfy the equations

$$F(z) - \frac{i}{z}F(1/z) = \frac{2}{\pi}\int_C \frac{tz}{t^2 z^2 - 1} F(t)\,dt$$

and

$$F(z) + \frac{i}{z}F(1/z) = \frac{2}{\pi}\int_D \frac{tz}{t^2 z^2 - 1} F(t)\,dt$$

where C and D are contours from 0 to $+\infty$ in the half-plane $R(t) > 0$ and C passes above $t = 1/z$ while D passes below $t = 1/z$. If the analytic continuation of a function $f(z)$ is denoted by $[f(z)]$ then we have the functional equation

$$[F(z) - \frac{i}{z}F(1/z)] + [F(-z) - \frac{i}{z}F(-1/z)] = 0$$

for all values of z except those on a cut from 0 to $-i\infty$. The results are extended to the function $\psi_k(z)$ defined for real k and $R(z) > 0$ by

$$\phi_k(z) = z^k \sum_{n=1}^{\infty} \frac{n^{2k}}{e^{2\pi nz} - 1} = z^k \sum_{n=1}^{\infty} \sigma_{2k}(n) e^{-2\pi nz}$$

where $\sigma_k(n)$ is the sum of the kth powers of the divisors of n. L. S. G.

517.53 : 517.948 : 517.522 *see Abstr.* 51

517.531 = 4 52

Some inequalities concerning analytic functions. CARLSON, F. *Ark. Mat. Astr. Fys.*, 29*B*, 4, *No.* 11, 7 *pp.*, 1943.—Let $f(\omega)$ be an analytic function of ω (complex), regular within and on a circle C, and let L be a convex closed curve within C. Inequalities are studied of the type

$$\int_L \{f(z)\}^k dz \leqslant \frac{2\Omega}{\pi}\int_C \{f(\omega)\}^k d\omega$$

where k is a real number > 0 and Ω is the greatest angle subtended by L at a point of C. We always have $\Omega \leqslant \pi$. By means of a conformal transformation the results may be extended to curves L lying within a semi-plane. L. S. G.

517.544.2 : 536.2.01 53

Note on Green's functions in the theory of heat conduction. LOWAN, A. N. *Phil. Mag.*, 35, *pp.* 495–498, *July*, 1944.—Integral formulae for the Green's function (G), subject to various boundary conditions, are given for the following 3 domains: (A) $0 < x < \infty$, $0 < y < \infty$; (B) $0 < x < \infty$, $0 < y < \infty$, $-\infty < z < \infty$; (C) $0 < x < \infty$, $0 < y < \infty$, $0 < z < \infty$. In the first case, if there are sources at the points (ξ, η), $(-\xi, -\eta)$ and sinks at $(\xi, -\eta)$, $(-\xi, \eta)$ we have

$$G = \frac{4}{\pi^2}\int_0^{\infty}\int_0^{\infty} L(x, y, \xi, \eta) \exp\{-k(\alpha^2 + \beta^2)t\} d\alpha d\beta$$

where $L(x, y, \xi, \eta) = \sin \alpha x \sin \beta y \sin \alpha\xi \sin \beta\eta$ when $G = 0$ for $x = 0$ and $y = 0$. The other formulae are similar. L. S. G.

517.564.3 54

Infinite integrals involving generalized hypergeometric functions. SINHA, S. *Bull. Calcutta Math. Soc.*, 36, *pp.* 15–30, *March*, 1944.—6 types of integrals are evaluated similar to those of a previous paper [Abstr. 995 (1944)], the term $K_\lambda(ax)K_\mu(ax)$ now being replaced by other Bessel functions of the form $J_\lambda(ax)J_\mu(bx)$, $I_\lambda(ax)I_\mu(bx)$, etc. L. S. G.

517.566 : 517.6 *see Abstr.* 56

517.566.3 55

On a class of functions suggested by the zeta of Riemann. HURWITZ, S. *Ann. Math., Princeton*, 45, *pp.* 340–346, *April*, 1944.—Some theorems are obtained concerning the class of functions $\sum n^{-1}(\log n)^{-s}$, $\sum (n \log n)^{-1}(\log \log n)^{-s}$, . . ., where $s = \sigma + it$. Let

$$\log_0 x = x, \quad \log_{p+1} x = \log(\log_p x) (p = 0, 1, 2, \ldots)$$
$$e_0(x) = x, \quad e_{p+1}(x) = \exp\{e_p(x)\}$$
$$f_0(x) = 1, \quad f_{p+1}(x) = 1 \Big/ \prod_{i=o}^{p} (\log_i x)$$

and $g_p(x, s) = f_p(s)(\log_p x)^{-s}$. Also, write u, v, w in place of $[e_{p-1}(0)]$, $[e_p(0)]$ and $[e_{p+1}(0)]$, respectively, where $[x]$ denotes the integral part of x. The paper is concerned with the properties of the function $\zeta_p(s) = \sum_{n=v+1}^{\infty} g_p(n, s)$. It is proved that $\zeta_p(s)$ is regular everywhere except at $s = 1$. A definite integral for $\zeta_p(s)$ is found and this leads to the contour integral

$$\frac{\zeta_p(s)}{\Gamma(1-s)} = \frac{1}{2\pi i}\int_C z^{s-1}\zeta_{p-1}^*(1-z)dz$$

where C starts at $-\infty$ on the negative real axis, encircles the origin once in a positive direction and returns to its starting point. Here ζ_{p-1}^* is defined by $\zeta_{p-1}^*(1+s) = \zeta_{p-1}(1+s) - \sum_{n=u+1}^{v} g_{p-1}(n, 1+s)$. The contour integral leads to the Laurent expansion $\zeta_{p-1}^*(1-z) = -\frac{1}{z} + \sum_{n=0}^{\infty} \frac{\zeta_p(-n)}{n!} z^n$ and from this result it is deduced that $\zeta_p(s)$ has an infinity of negative zeros, although there is no indication of their numerical values. The last section deals with the asymptotic behaviour of $\zeta_p(s)$. On a circle, centre $s = 0$ and sufficiently large radius r, we have

$$\exp(r^{1-\varepsilon}) < \max|\zeta_p(s)| < \exp(r^{1+\varepsilon})$$

while on a vertical line to the right of $\sigma = 1$, $\zeta_p(s)$ is

bounded and on $\sigma = 1$, $\zeta_p(s) = O(\log_{p+1} t)$ but $\zeta_p(s) > A \log_{p+2} t$ for an arbitrarily large t. L. S. G.

517.6 : 517.566 56

Note on certain integrals involving Hermite's polynomials. BABER, T. D. H., AND MIRSKY, L. *Phil. Mag.*, 35, *pp.* 532–537, *Aug.*, 1944.—The integrals evaluated are of the form $I_t(m, n, s) = \int_{-\infty}^{\infty} \xi^s \psi_m(\xi) \frac{d^t \psi_n}{d\xi^t} d\xi$, where m, n, s, t are non-negative integers and $\psi_m(\xi) = [2^m m! \sqrt{(\pi/\alpha)}]^{-\frac{1}{2}} e^{-\frac{1}{2}\alpha\xi^2} H_m(\xi\sqrt{\alpha})$, α being a constant and $H_m(\xi)$ the mth Hermitian polynomial. Integrals of this type frequently occur in quantum-mechanical problems. A table of values of all non-vanishing integrals $I_t(m, n, s)$ is given for which (I) $t = 0$, $0 \leqslant s \leqslant 6$, or (II) $t = 1$, $0 \leqslant s \leqslant 5$, or (III) $t = 2$, $0 \leqslant s \leqslant 4$. All results hold for $n \geqslant 0$. L. S. G.

517.63 : 513.77 57

Laplace transforms of a class of higher dimensional varieties in a projective space of n dimensions. CHERN, S. S. *Proc. Nat. Acad. Sci., Wash.*, 30, *pp.* 95–97, *April*, 1944.—Cartan's method of moving frames is used to develop the differential geometry of an r-dimensional variety V_r. At a generic point of V_r, an asymptotic net (of quadric cones) is introduced, generalizing the asymptotic tangents of a surface. The Laplace transforms of a type of variety studied by Cartan are generalized. L. S. G.

517.9 : 519.3 58

On the existence of a metric for higher space paths. SEETHARAMAN, V. *Proc. Indian Acad. Sci. A*, 19, *pp.* 167–176, *April*, 1944.—The problem is to investigate the conditions under which the system (S) of equations

$$\frac{d^{(\sigma+1)}x^i}{dt^{(\sigma+1)}} + \Gamma^i(t, x, x^1, \ldots, x^{(\sigma)}) = 0 \quad i = 1, 2, \ldots n, \sigma \geqslant 2$$

may be identified with the extremals of a regular problem of the calculus of variations, $\delta \int f dt = 0$. It is shown that the necessary and sufficient condition is that the equations of variation of S be self-adjoint. L. S. G.

517.92 : 576.35 59

A note on equations of growth. MORALES, M. F. *Science*, 99, *pp.* 490–491, *June* 16, 1944.—The equation considered is $dN/dt = \sum_{i=0}^{m} h_i N^{\gamma i}$ where $h_0, \ldots, h_m$ are functions of time. A method is outlined for obtaining $h_0, \ldots, h_m$ at the point (N, t) using the curve of growth. L. S. G.

517.934 60

On Van der Pol's and related non-linear differential equations. SHOHAT, J. *J. Appl. Phys.*, 15, *pp.* 568–574, *July*, 1944.—If the equation

$$\frac{d^2u}{dt^2} - \varepsilon F(u)\frac{du}{dt} + u = 0 \qquad (\varepsilon > 0)$$

has periodic solutions, of period close to 2π, then under certain conditions on $F(u)$, such a solution $u(t)$ may be accurately approximated for all t by the first term $A_1 \sin(\nu t + \alpha_1)$ of its Fourier expansion. This is shown by means of the Parseval formula. When $F(u)$ is a given polynomial $\sum_{i=0}^{p} \alpha_i u^i$, the coefficient A_1 is given approx. by a root of

$$\alpha_0 + \sum_{i=1}^{m} \alpha_{2i} \frac{1 \cdot 3 \ldots (2i-1)}{2 \cdot 4 \ldots 2i} \frac{z^i}{i+1} = 0$$

where $z = A_1^2$. When $\varepsilon \ll 1$, a power-series method is used to find expansions for $u(t)$ and its frequency ν. This is done in detail for Van der Pol's equation given by $F(u) = 1 - u^2$, but it applies when $F(u)$ is any polynomial. For $\varepsilon \gg 1$, this method presents difficulties, but a new method is given which permits a series expansion of u and ν for all values of σ. It is found that $\nu = \frac{1}{1+\varepsilon} + \frac{\varepsilon}{(1+\varepsilon)^2} + \frac{15}{16}\frac{\varepsilon^2}{(1+\varepsilon)^3} + \ldots$ which leads to the asymptotic formula $\nu\varepsilon \sim 3 \cdot 89$ as $\varepsilon \to \infty$. L. S. G.

517.941.92 : 517.512.71 *see Abstr.* 49

517.942.4 : 534.11 : 531.391.3 *see Abstr.* 102

517.942.932 61

A property of certain differential equations. SAWYER, W. W. *Quart. J. Math.*, 15, *pp.* 34–39, *March–June*, 1944.—Let $u(x)$ and $v(x)$ be solutions of $E_0 \equiv a_0(x)y'' + b_0(x)y' + c_0(x)y = 0$ and let $u^{(n)}(x)$ and $v^{(n)}(x)$, the nth derivatives of $u(x)$ and $v(x)$ be the solutions of $E_n \equiv a_n(x)y'' + b_n(x)y' + c_n(x)y = 0$. The equations E_n are supposed to be of the Fuchsian type with $a_n(x)$, $b_n(x)$, $c_n(x)$ polynomials in x. A point $x = \xi$ which is singular for E_0 is also singular for $E_n (n > 0)$ so that $a_n(\xi) = 0$ for all n. But points $x = \eta$ may also exist for which $a_n(\eta) = 0$ and at which $u^{(n)}(x)$ and $v^{(n)}(x)$ are regular. Such points are called apparent singularities of E_n. The following two theorems are proved: I. If the degree of $a_n(x)$ is independent of n, the equation E_0 has at most 3 singularities (one necessarily at infinity), together with a finite number of apparent singularities. II. The apparent singularities of E_n are the roots of an equation $\Phi_n(x) = x^p + \alpha_{1,n} x^{p-1} + \ldots + \alpha_{p,n} = 0$ where $\alpha_{s,n}$ is a polynomial in n of degree s. L. S. G.

517.945 : 532.51 : 539.385 62

On a class of differential equations in the mechanics of continua. BERS, L., AND GELBART, A. *Quart. Appl. Math.*, 1, *No.* 2, *pp.* 168–188, *July*, 1943.—The equations are of the form $\partial u/\partial x = \tau_1(y)\partial v/\partial y$ and $\partial u/\partial y = -\tau_2(y)\,\partial v/\partial x$ and their similarity to the Cauchy–Riemann equations ($\tau_1 = \tau_2 = 1$) suggests an integration theory similar to that of complex function theory. Such a theory is presented. If u and v are a pair of solutions, the functions $U = \int_{z_0}^{z} u dx - \tau_2 v dy$ and $V = \int_{z_0}^{z_1} v dx + \frac{u}{\tau_1} dy$ are also solutions, and a set of particular solutions may be found by repeating this process indefinitely. Special attention is given to the case $\tau_1 = \tau_2 = y^{-n}$. Three physical applications are discussed: flow of an incompressible fluid with rotational symmetry, torsion of bodies of revolution and two-dimensional potential gas flow. L. S. G.

517.946.9 : 539.214 63

A boundary problem in plane plasticity. COBURN, N. *J. Math. Phys.*, 23, *pp.* 61–68, *May*, 1944.—A perfectly plastic material occupies the semi-space $x > 0$ and at any interior point there exist (i) the normal stresses σ_x and σ_y acting parallel to the x- and y-axes

espectively, and (ii) the shear stress σ_{xy}. The Airy tress function $F(x, y)$ satisfies $\sigma_x = \frac{\partial^2 F}{\partial y^2}$, $\sigma_y = \frac{\partial^2 F}{\partial x^2}$ nd $\sigma_{xy} = -\frac{\partial^2 F}{\partial x \partial y}$. The relations $\sigma_x = \sigma + k \sin 2\gamma$, $_y = \sigma - k \sin 2\gamma$, $\sigma_{xy} = -k \cos 2\gamma$ where k is onst., σ is the mean normal stress and γ is the angle etween the tangent to one family of slip lines and the -axis, lead to the equations

$$\frac{\partial^2 F}{\partial x \partial y} = -k \cos 2\gamma, \quad \frac{\partial^2 F}{\partial y^2} - \frac{\partial^2 F}{\partial x^2} = 2k \sin 2\gamma$$

These (hyperbolic) equations are solved subject to the oundary conditions: $\sigma_x(o, y) = \phi(y)$, $\sigma_{xy}(o, y) = \theta(y)$. The first equation yields the stresses in terms of the oundary conditions and $\sin 2\gamma$ and the second quation yields $\cos 2\gamma$ in terms of the boundary onditions. A boundary curve is determined which is line of rupture in the sense of Christianovich (*Recueil Math. (Moscow)*, 1, 43, 1936, p. 511].

L. S. G.

517.947.4 = 4 64

On the distribution of the proper values of problems governed by the equation $\Delta u + \lambda k(x, y)u = 0$. LEILEL, A. *Ark. Mat. Astr. Fys.*, 29 *B*, 2, *No.* 7, pp., 1943.—Let S be a finite domain with a boundary T. 2 problems are studied: I. $\Delta u + \lambda k(x, y)u = 0$ on S, $u = 0$ on T. II. $\Delta u + \mu k(x, y)u = 0$ on S, $\frac{\partial u}{\partial n} = 0$ on T. Let the proper values of I be $0 \leqslant \lambda_1^+ \leqslant \lambda_2^+ \leqslant \ldots$; $0 \geqslant \lambda_1^- \geqslant \lambda_2^- \geqslant \ldots$ and let the proper values of II be $0 \leqslant \mu_1^+ \leqslant \mu_2^+ \leqslant \ldots$; $0 \geqslant \mu_1^- \geqslant \mu_2^- \geqslant \ldots$. The parts of S characterized by $k(x, y) > 0$ and $k(x, y) < 0$ are denoted by S^+ and S^- respectively. The following result (generalizing an earlier one due to Weyl) is proved concerning the asymptotic distribution and magnitude of the proper values: If $N_I^+(t)$, $N_{II}^+(t)$ denote the number of positive proper values of I and II which are $\leqslant t$, and $N_I^-(t)$, $N_{II}^-(t)$ the number of negative proper values which are $\geqslant t$ then we have

$$\left.\begin{matrix} N_I^+(t) \\ N_{II}^+(t) \end{matrix}\right\} \sim \frac{t}{4\pi}\int_{S^+} k(x, y)dxdy \text{ as } t \to \infty$$

$$\left.\begin{matrix} N_I^-(t) \\ N_{II}^-(t) \end{matrix}\right\} \sim \frac{t}{4\pi}\int_{S^-} k(x, y)dxdy \text{ as } t \to \infty$$

Putting $t = \lambda_n^+, \mu_n^+, \lambda_n^-, \mu_n^-$ in these relations we have

$$\left.\begin{matrix} \lambda_n^+ \\ \mu_n^+ \end{matrix}\right\} \sim \frac{4\pi n}{\int_{S^+} k(x, y)dxdy}, \quad \left.\begin{matrix} \lambda_n^- \\ \mu_n^- \end{matrix}\right\} \sim \frac{4\pi n}{\int_{S^-} k(x, y)dxdy} \text{ as } n \to \infty$$

L. S. G.

517.947.42 : 537.213 65

A new method of solution of the boundary value problems of Laplace's equation relating to two spheres. I. MITRA, S. K. *Bull. Calcutta Math. Soc.*, 36, *pp.* 31–39, *March*, 1944.—This classical problem is solved by a new method in which 2 sets of spherical polar coordinates are used, and the field is expressed in terms of 2 infinite series whose coefficients A_n and B_n satisfy the infinite set of linear equations

$$A_0 = \frac{V_a}{2\pi a} - \frac{b}{a}\sum_{n=0}^{\infty}(-)^n B_n q^{n+1}$$

$$A_m = -\frac{b}{a}p^m \sum_{n=0}^{\infty}(-)^n \frac{(m+n)!}{m!\,n!} B_n q^{n+1}$$

$$B_0 = \frac{V_b}{2\pi b} - \frac{a}{b}\sum_{n=0}^{\infty} A_n p^{n+1}$$

$$B_m = -\frac{a}{b}(-q)^m \sum_{n=0}^{\infty}\frac{(m+n)!}{m!\,n!} A_n p^{n+1}$$

Here V_a and V_b are the potentials of the spheres (of radii a and b) and $p = a/c$, $q = b/c$ where c is the distance between the centres. By writing

$$f(z) = \sum_{m=0}^{\infty} A_m z^m, \quad g(z) = \sum_{m=0}^{\infty}(-)^m B_m z^m$$

it is easy to derive the functional equations

$$f(z) = \frac{V_a}{2\pi a} - \frac{bq}{a(1-pz)} g\left(\frac{q}{1-pz}\right)$$

$$g(z) = \frac{V_b}{2\pi b} - \frac{ap}{b(1-qz)} f\left(\frac{p}{1-qz}\right)$$

These are solved by means of difference equations and exact values for A_n and B_n are found, leading to exact values for the coefficients of capacitance and inductance. L. S. G.

517.948 : 517.53 : 517.522 *see Abstr.* 51

517.948.32 66

On the numerical solution of certain types of integral equations. REIZ, A. *Ark. Mat. Astr. Fys.*, 29 *A*, 4, *No.* 29, 21 *pp.*, 1943.—Fredholm's equation of the 2nd kind, $f(x) = F(x) + \lambda\int_a^b K(x, y)f(y)dy$, is solved in the usual way by replacing the equation by a finite system of linear equations. When $a = -\infty$, $b = \infty$, the integral is replaced by a weighted sum where the weights are determined by the use of Hermite polynomials $H_n(x)$ $(n = 1, 2, \ldots)$. The theorem used is that

$$\int_{-\infty}^{\infty} e^{-x^2}\Phi(x)dx \approx \sqrt{\pi}\sum_{i=1}^{n} p_i \Phi(x_i), \quad n \to \infty$$

where $x_1, \ldots, x_n$ are the n roots of $H_n(x)$ and

$$p_i = 2^{n+1}n!/[H_n'(x_i)]^2$$

When $a = 0$, $b = \infty$, the weights are found with the use of Laguerre polynomials $L_n(x)$ using the result

$$\int_0^{\infty} e^{-x}\Phi(x)dx \approx \sum_{i=1}^{n} q_i \Phi(x_i) \qquad n \to \infty$$

where $x_1, \ldots, x_n$ are now the roots of $L_n(x)$, and $q_i = (n!)^2/x_i[L_n'(x_i)]^2$. Examples of each process are given. 2 methods are also given (together with examples) for solving equations of the 1st kind,

$$F(x) = \int_a^b K(x, y)f(y)dy$$

One of these involves the method of least squares, the other makes use of an interpolation formula for $f(y)$. L. S. G.

517.948.34 : 537.591.8 67

On the convergency of the solutions of cascade equations in cosmic radiation. CHAKRABARTY, S. K. *Bull. Calcutta Math. Soc.*, 36, *pp.* 9–13, *March*, 1944.—

It is shown that the solution obtained in a previous paper [Abstr. 1976 (1943)] is absolutely convergent for all physically admissible values of the energy and the time. It is not necessary to introduce the process of analytic continuation as was done previously [Abstr. 2764 (1942)]. L. S. G.

517.949.12 68

On reciprocal differences in two variables. SINGH, B., AND DAS GUPTA, P. N. *Bull. Patna Sci. Coll. Phil. Soc., pp.* 5–8, *Jan.*, 1944.—An interpolation formula involving continued fractions is obtained for a function of two variables. L. S. G.

518.1 69

Recent progress in scientific computing. COMRIE, L. J. *J. Sci. Instrum.*, 21, *pp.* 129–134, *Aug.*, 1944.—A description is given of various differential analysers and calculating machines. The application of the latter to numerical integration, formation of differences and checking of tables, problems of interpolations, etc. is pointed out. Punched-card machines are described. L. S. G.

518.4 70

A chart for plotting relations between variables over their entire real range. DONNELL, L. H. *Quart. Appl. Math.*, 1, *pp.* 276–277, *Oct.*, 1943.—A simple graphical method for plotting $y = f(x)$ or $x = g(y)$. It consists of an ordinary Cartesian plot over the range (− 1, 1) of each variable and a plot of the reciprocal of the variables from 0 to − 1 and 1 to 0. L. S. G.

518.5 : 621.3.09 71

Universal circuit slide-rule. GREENFIELD, E. W. *Elect. World, N.Y.*, 122, *p.* 116, *Aug.* 19, 1944.—[Abstr. 43 B (1945)].

519.21 72

The limiting distribution of a general class of statistics. HSU, P. L. *Sci. Rec., Acad. Sinica*, 1, 1–2, *pp.* 37–41, *Aug.*, 1942.—Many common statistics are functions, with a high degree of regularity, of means $f(\bar{u}_1, \bar{u}_2, \ldots, \bar{u}_m)$ where $\bar{u}_i = n^{-1}\sum_{r=1}^{n} u_{ir}$ and where every pair $u_{ir}, u_{js} (r \neq s)$ are statistically independent. The limiting distributions of all such statistics as $n \to \infty$ are found, the problem being formulated and solved in the language of pure probability theory. L. S. G.

519.21 73

A problem in the random distribution of particles. EGGLETON, P., AND KERMACK, W. O. *Proc. Roy. Soc. Edinb. A*, 62, 1, *pp.* 103–115, 1944.—*N* particles are arranged at random on a line of length *L*. An $n : l$ consists of $n (\leqslant N)$ particles contained in a length $l (< L)$. An expression is found for the average number of distinct n : l's in a length L when the line is closed and also when the line is open. Analogous problems are considered in 2 dimensions where the particles are arranged at random on a plane and the length l is replaced by an oriented rectangle. The extension to 3 dimensions is discussed briefly and some of the difficulties are noted. L. S. G.

519.21 74

Solution of the restricted problem of the random walk. SILBERSTEIN, L. *Phil. Mag.*, 35, *pp.* 538–543, *Aug.*, 1944.—A particle, moving in a plane, starts from a point O and makes n rectilinear (unit) steps. Each step may occur in either of 2 fixed directions. The problem is to find the probability $p_n(x, y)$ of reaching a point (x, y) in n steps. It is shown that if $f_n(x, y)$ is the number of ways of reaching a point (x, y) in n steps [so that $p_n(x, y) = \frac{1}{4^n} f_n(x, y)$] then $f_n(x, y)$ is given by the functional equation

$$f_{n+1}(x, y) = f_n(x + 1, y) + f_n(x - 1, y) + f_n(x, y + 1) + f_n(x, y - 1)$$

By writing $\sigma = x + y$, $\delta = x - y$ and assuming

$$f_n(x, y) = g_n(\sigma) h_n(\delta)$$

the variables may be actually separated and it is found that g_n and h_n each satisfy the simple difference equation $\phi_{n+1}(s) = \phi_n(s) + \phi_n(s - 1)$, which has the solution

$$\phi_n(s) = \binom{n}{\frac{1}{2}(n + s)}$$

Thus $$p_n(x, y) = \frac{1}{4^n}\binom{n}{\frac{1}{2}(n + \delta)}\binom{n}{\frac{1}{2}(n + \sigma)}$$

The asymptotic value of $p_n(x, y)$ (for large n) is found to be

$$p_n(x, y) \sim \frac{2}{\pi n} e^{-(x^2 + y^2)/n}$$

L. S. G

519.214 7

The accumulation of chance effects and the Gaussian frequency distribution. SILBERSTEIN, L. *Phil. Mag.* 35, *pp.* 395–404, *June*, 1944.—A situation is considered where the effect of a process, in a single trial, is equally likely to have any value between 0 and 1, and the probability, $p_n(x)dx$, that the resultant effect of an n-fold repetition of the process shall fall between x and $x + dx$ is found. It is shown that $p_n(x)$ satisfies the recurrence relation

$$p_{n+1}(x) = \int_{x-1}^{x} p_n(u)du \qquad (n \geqslant 1$$

where $p_1(x) = 1$ for $0 < x < 1$ and zero elsewhere. The values of $p_n(x)$ are found for small values of n but to study the behaviour as $n \to \infty$ a Fourier integral is used to write $p_n(x)$ in the form

$$p_n(x) = \frac{2}{\pi}\int_0^\infty \left(\frac{\sin u}{u}\right)^n \cos 2\left(x - \frac{n}{2}\right)u\,du$$

For large n this integral consists mostly of contributions from the neighbourhood of $u = 0$. Writing $\sin u/u \approx 1 - u^2/6 \approx e^{-u^2/6}$ we deduce, for the deviation from the mean $\xi = x - \frac{1}{2}n$, the value

$$p_n(\xi) = \frac{2}{\pi}\int_0^\infty e^{-nu^2/6} \cos(2\xi u)du = \sqrt{\left(\frac{6}{\pi n}\right)} e^{-6\xi^2/n}$$

which is precisely the Gauss law of error. Expressions are found for the standard deviation and the relative standard deviation. L. S. G

519.24 : 159.9 : 512.831 *see Abstr.* 18

519.24 ; 37.015 *see Abstr.* 1

519.241 7

On a measure of divergence between two statistical populations defined by their probability distributions. BHATTACHARYYA, A. *Bull. Calcutta Math. Soc.*, 3 *pp.* 99–109, *Sept.*, 1943.—If $(\pi_1, \pi_2, \ldots, \pi_k)$ an

$\pi'_1, \pi'_2, \ldots, \pi'_k$) are the population probabilities of ae k exhaustive and mutually exclusive ways of ccurrence, the measure of divergence is taken to Δ^2 where $\cos\Delta = \sum_{i=1}^{k} (\pi_i\pi')^{1/2}$. This has a simple ometric interpretation in an Euclidean space R_k ice $\sum_{i=1}^{k} \pi_i = \sum_{i=1}^{k} \pi'_i = 1$. Reasons are given for vouring this measure of divergence and the possi- lity is considered of using a monotonically increasing nction of Δ in place of Δ^2. The method is tended from discrete to continuous distributions by king s Δ

$$\int \sqrt{\{\phi(x_1, \ldots, x_k)\phi'(x_1, \ldots, x_k)\}}^{1/2} dx_1 dx_2 \ldots dx_k$$

nere $\phi(x)dx$ and $\phi'(x)dx$ are the probability distri- itions of the variates $x_1, x_2, \ldots, x_k$ in the two ses. Some applications are made, including one nere the divergence between two univariate normal pulations differs in their means and standard viations. L. S. G.

9.272 : 512.831 *see Abstr.* 19, 20

9.283 77

Stability after the war. RICHARDSON, L. F. *ture, Lond.*, 154, *p.* 240, *Aug.* 19, 1944.—Differential uations describing defeat or submission are given d these may later indicate a trend towards war. It pointed out that there is no evidence for the belief at Europe will be permanently stabilized by sub- ssiveness on the part of defeated nations. L. S. G.

9.3 : 517.9 *see Abstr.* 58

9.44 78

On S-groups. JABBER, M. A. *Bull. Calcutta ath. Soc.*, 35, *pp.* 111–113, *Sept.*, 1943.—An *S*-group one in which the commutator operation is asso- tive. The free *S*-group generated by $a_1, \ldots, a_n$ defined and it is shown that each *S*-group generated n elements is homomorphic to this free *S*-group. method is given for classifying the various systems relations that may hold in an *S*-group. L. S. G.

9.48 : 511.28 *see Abstr.* 5

9.49 = 3 79

A simplified proof of the principal-ideal theorem of ssical field theory. BERGSTRÖM, H. *Ark. Mat. r. Fys.*, 29 *B*, 2, *No.* 6, 6 *pp.*, 1943.—To prove the orem it is sufficient to prove a result, due to Artin, ncerning metabelian groups. Some properties of latter are used to deduce this result. [See Abstr. 5 (1944)]. L. S. G.

9.5 : 530.1 : 512 *see Abstr.* 13

.045 80

A case of polytropic equilibrium configuration with iable angular velocity. ROY, S. K. *Bull. Calcutta ath. Soc.*, 35, *pp.* 85–98, *Sept.*, 1943.—The problem ated is the equilibrium of polytropes distorted by a iable rotation. The equations of rotational uilibrium are solved and an expression for the ential obtained in terms of Emden functions. The racteristic constants of a rotating polytrope are culated and a formula is derived for the difference between the equatorial and polar distortions. The mean density of the star is also calculated. An application is made to a particular case. L. S. G.

523.11 : 530.12 81

Models of the universe and cosmological time-scales. MCVITTIE, G. C. *Nature, Lond.*, 154, *pp.* 477–481, *Oct.* 14, 1944.—The paper contains a descriptive account of the present theories of cosmology. A model of the universe is provided by a set of points moving in a 4-dimensional space-time, these points being the counterparts of the spiral nebulae. The general principles of homogeneity and of the geodesic paths for particles and light rays lead, not to a unique model, but to a class of possible models. A variety of time co-ordinates are possible in a given model giving different ages to the universe. Different models are chosen out of this wide class provided by theory in different ways by different authors. Eddington obtains one which starts expanding from an equilibrium state, through his unification of relativity and quantum theory. Milne obtains a different model from his kinematical relativity. The author obtains a third by comparing the theoretically predicted formula for the distribution of spiral nebulae in space with the observed. The three models are not mathematically reducible to one another. G. C. McV.

523.842.3 82

The spectrographic binary Lambda Andromedae. WALKER, E. C. *J. R. Astr. Soc. Can.*, 38, *pp.* 249–254, *July–Aug.*, 1944.—The possibility of a rotation of the line of apsides in λ Andr is investigated by recomputing an orbit from 27 spectrograms taken at the Dominion Astrophysical Observatory. The elements found agree exactly, within the probable errors, with those found from Lick plates taken nearly 40 yr. ago. A. HU.

523.872 83

The resonance lines of Li I and Na I in spectra of the red carbon stars. MCKELLAR, A., AND STILWELL, W. H. *J. R. Astr. Soc. Can.*, 38, *pp.* 237–248, *July–Aug.*, 1944.—Spectrograms of 42 red carbon stars are studied in the regions near 6 708 Å and 5 890 Å. Nearly all show evidence of Li I absorption, though blending with a CN line reduces the measured wavelength. The average equiv. width for the *D* lines is 13 Å, but for their Li I analogues it is only 0·6 Å. No marked correlation exists betw. the intensity of Na I and that of Li I, or betw. either intensity and spectral type. The very great strength of Li I in WZ Cass may be due either to abnormal abundance or to low excitation. A. HU.

525.61 = 4 84

Contributions to the analytical theory of tides. III–V. OSEEN, C. W. *Ark. Mat. Astr. Fys.*, 29 *A*, 1, *No.* 1, 37 *pp.*; 29 *A*, 2, *No.* 8, 10 *pp.*, *and* 29 *A*, 2, *No.* 9, 9 *pp.*, 1943.—The equations describing the oscillations of an incompressible viscous fluid rotating about an axis are written down [see Abstr. 1264 (1944)] and simple solutions are found. These are derived from solutions of an equation of the form $(\mu\Delta - iv)^2\Delta F + 4\Omega^2\partial^2 F/\partial x_3^2 = 0$, which is studied in detail. Some particular cases are examined and the results compared with previous work. Two types of waves occur, one of which is stationary. L. S. G.

53 : 571 85

The use of physics and the methods of physics in archaeology. WEBB, W. S. *Amer. J. Phys.*, 12, *pp.* 196–200, *Aug.*, 1944.

530.1 : 519.5 : 512 *see Abstr.* 13

530.12 86

The affine connection in physical field theories. SCHRÖDINGER, E. *Nature, Lond.*, 153, *pp.* 572–575, *May* 13, 1944.—The introduction of the idea of general invariance into the restricted theory of relativity causes a loss in the connection between neighbouring points and this is restored by introducing an affine connection. Theories of curvature are discussed and the particular affinity resulting from a Riemannian metric is treated briefly. The theories of Weyl and of Eddington are mentioned and the restrictive Hamiltonian principle (leading to the field equations) is introduced. The field theories of electromagnetism and gravitation are discussed and the meson field (responsible for nuclear binding) is treated. It is described by a 6-vector-field governed by equations, of which Maxwell's are a special case. The need for a field theory which embraces each of these three fundamental fields is pointed out and recent efforts in this direction are discussed briefly. L. S. G.

530.12 87

Boundaries of space and time. EDGEWORTH, K. E., DINGLE, H. *Nature, Lond.*, 154, *p.* 305, *Sept.* 2, 1944.

530.12 88

The deflection of light and relativity. NARLIKAR, V. V. *Nature, Lond.*, 154, *p.* 400, *Sept.* 23, 1944.

530.12 : 513.0 *see Abstr.* 22

530.12 : 523.11 *see Abstr.* 81

530.12 : 536.33 *see Abstr.* 208

530.145.5 : 537.12 89

New determinations of h/e with X-rays. OHLIN, P. *Ark. Mat. Astr. Fys.*, 29 *B*, 2, *No.* 4, 6 *pp.*, 1943.—The apparatus, consisting of a high-vacuum spectrometer with bent crystal and Geiger counter, was used to investigate the structure in the short-wavelength limit of the continuous X-ray spectrum. The counter was filled with a mixture of rare gases and alcohol vapour and was thereby 6 to 8 times more sensitive to soft X-rays than the corresponding air-filled counter. From the isochromats registered during the structure experiments, values of h/e were calculated from the short-wavelength limit. The measurements were made with 2 wavelengths, 3 351·85 X.U. ($CaK\alpha_1$) and 2 742·87 X.U. ($TiK\alpha_1$) and W, Cu, Ag and MoS_2 were used as anticathode materials. The average value of h/e was found to be $1{\cdot}37884 \times 10^{-17}$ and this is compared with other values obtained by various authors. [Abstr. 2082 (1934), 4865 (1935), 2149 (1937)]. L. S. G.

530.145.6 90

Quantum mechanics of fields. II. Statistics of pure fields. BORN, M., AND PENG, H. W. *Proc. Roy. Soc. Edinb. A*, 62, 1, *pp.* 92–102, 1944.—[See Abstr. 1017 (1944)]. A physical representation of the constants of motion k_x, k_y, k_z, forming the vector k of the new theory, is sought. It is shown that they describe the entire configuration of the wave vectors, and may be called the configuration wave vector of the assembl of apeirons which make up a volume of field. Th term apeiron is suggested for the system describe in the theory by step-matrices, an apeiron of wav vector k being the kth radiation oscillator considere as a kind of material particle. The probability c distribution of quanta among the apeirons of th various intervals is worked out. The canonical di tribution of quanta is then obtained by assuming a arbitrary apeiron distribution. All the harmoni oscillators of low frequencies must be occupied b apeirons for the electromagnetic field. Similarly, th canonical distribution of the apeirons is obtained b assuming an arbitrary distribution of quanta.

A. J. M

530.145.61 9

A note on the evaluation of the Schrödinger hydr genic intensity integral. WHEELER, T. S. *Proc. I Irish Acad.*, 50 *A*, 2, *pp.* 7–12, 1944.—The integral needed in a determination of the intensities of th hydrogen lines and their fine-structure component Previous methods of evaluation [Abstr. 998 (1927 519 (1930)] were somewhat involved. In the preser paper the integral is evaluated directly by using th Schrödinger generating function for associate Laguerre polynomials. L. S.

530.145.63 9

Spinor representations of rotations and Dirac equations in five-dimensional space. ERIKSSO H. A. S. *Ark. Mat. Astr. Fys.*, 29 *A*, 2, *No.* 14, 9 *p* 1943.—The Cayley representation of the gener orthogonal matrix, $A = (E - S)(E + S)^{-1}$, where is orthogonal and S is skew-symmetric, is writte down in detail for the case $n = 5$. By means of th 10 parameters involved (in S), 8 new complex par meters (16 real parameters satisfying 6 condition are formed, and these define a linear transformatio of complex numbers, called spinor components. five-vector is transformed like certain linear cor binations of products of these components. Th Lorentz transformations are considered as a speci case and the Dirac equations in 5-dimensional spa are derived by using the spinor formalism. L. S.

530.145.63 : 539.152.1

Calculations of the scattering of mesons by t matrix method. MA, S. T. *Sci. Rec., Acad. Sinic* 1, 1–2, *pp.* 123–129, *Aug.*, 1942.—The matrix meth of Kemmer and Wilson [Abstr. 4466 (1939), 25 (1940)] may be applied to scattering problems, n only when we are concerned with properties of t meson averaged over all the initial states of polari tion (when the spur method [Abstr. 2708 (1940)] used) but also when the aim is to study the behavio of one particular initial state. The meson equation $\sum_{\nu=1}^{4} \partial_\nu \beta_\nu \psi + (mc/h)\psi = 0$ where β_1, β_2, β_3, β_4 a 10×10 matrices, such that

$$\beta_4 = \begin{pmatrix} I & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & -I \end{pmatrix} \text{ and } \beta_j = \begin{pmatrix} 0 & \zeta_j & 0 \\ \zeta_j^\dagger & 0 & \tilde{\zeta}_j \\ 0 & \zeta_j^* & 0 \end{pmatrix} (j = 1, 2,$$

Here I is the unit matrix of order 3, ζ is a 3×4 mat and $\zeta^\dagger$, $\tilde{\zeta}$ and ζ^* are the Hermitian conjugate,

mplex conjugate and transpose of ζ, respectively. e ζ's are represented in the form

$$\sqrt{2}=\begin{pmatrix}0&0&0&-1\\0&0&-i&0\\0&i&0&0\end{pmatrix},\quad \zeta_2\sqrt{2}=\begin{pmatrix}0&0&i&0\\0&0&0&-1\\-i&0&0&0\end{pmatrix}$$

$$\zeta_3\sqrt{2}=\begin{pmatrix}0&-i&0&0\\i&0&0&0\\0&0&0&-1\end{pmatrix}$$

id the square matrices formed by the first 3 columns the ζ's are denoted by S_1, S_2, S_3. These are the in matrices of the meson. They are used to rive Duffin's commutation rule for the β's and the mmutation rules for the angular momentum, $S_2 - S_2S_1 = iS_3$, etc. The S's transform like a ctor and describe the dipole moment of the meson hile the symmetrical tensors $S_{ij} + S_{ji}$ correspond the quadripole moment of the meson [Abstr. 140 941)]. Proceeding from these results, the solution the meson equation is derived. An application is ade to the scattering of mesons, the transition obabilities of a meson in an electrostatic field being lculated by the Born approximations. The results e compared with previous results for electron attering [Abstr. 1324 (1934)]. The method may so be applied to the scattering of a meson by the clear interaction and to the scattering cross-sections longitudinal and transverse mesons [Abstr. 2857 938)]. L. S. G.

30.16 94

The laws of nature. DINGLE, H. *Nature, Lond.*, 53, *pp.* 731–736, *June* 17, *and pp.* 758–763, *June* 24, 944.—An attempt is made to reconcile the dissimi- rity which at present exists between the two funda- ental laws of motion and of temperature. Their ost marked difference is that whilst a course of ents could have taken place equally well in the verse direction, the extrapolation of the present mperature trend towards the past leads to an im- ossible physical state for the universe. It is shown at this difficulty has arisen as a result of our arbi- arily formulated laws and can be overcome by terations in our modes of expression of the laws ther than by a re-examination of the details of rrent theories. A new presentation of the pheno- enon of radiation along the lines of the relativity eatment of the phenomenon of motion is suggested. R. W. P.

30.16 95

On the quantization of probability. DUNLAP, H. F. *hys. Rev.*, 66, *pp.* 92–93, *Aug.* 1 *and* 15, 1944.—[See bstr. 821 (1944), 96 (1945)].

30.16 96

Comments on "On the Quantization of Proba- ility" by H. F. Dunlap. GOLDSMITH, A. N. *Phys. ev.*, 66, *p.* 93, *Aug.* 1 *and* 15, 1944.—[See Abstr. 95 1945)].

30.16 = 4 97

Experiment and deduction based on probability con- iderations. FÉRAUD, L. *Arch. Sci. Phys. Nat.*, 25, *ept.–Dec.* (*Suppl. No.* 3, *C.R. Soc. Phys. Hist. Nat. enève*, 60, 3, *pp.* 263–266), 1943.—The process of eduction is usually carried out in the absence of any questions of probability. If the latter is present, a new process is needed. Such is described and analysed. L. S. G.

531.15 98

On the representation of rigid rotations. BENEDIKT, E. T. *J. Appl. Phys.*, 15, *pp.* 613–615, *Aug.*, 1944.—The Euler formulae describing the rotation of a rigid body are written in vector form and formulae for the products and powers of certain vectors appearing in the transformation formulae are established. The results are compared with the representation by means of quaternions. L. S. G.

531.19 99

Relaxation processes in statistical systems. KRYLOV, N. *Nature, Lond.*, 153, *pp.* 709–710, *June* 10, 1944.—The two difficulties in establishing a connection between statistics and mechanics are (i) the introduction into mechanics of probability conceptions, (ii) the specification of the systems to which the results of statistical mechanics can be applied (e.g. the investigation of ergodic properties). The author rejects the ergodical hypothesis and introduces the idea of motions of the mixing type. The condition for the applicability of statistics is shown. The relaxation process is visualized as a process of mixing and the relaxation time is defined and studied. In the case of an ideal gas, a formula is found for the relaxation time. L. S. G.

531.19 : 533.7 : 536.7 100

Two-dimensional statistics of perfect gases of complicated molecules. BISWAS, B. N. *Bull. Calcutta Math. Soc.*, 36, *pp.* 45–48, *March*, 1944.—The molecules are assumed to have translational and internal motions and to be chemically non-interacting. General expressions are found for the energy, entropy and free energy of the gas [Abstr. 1024 (1944)] and the results have been successfully applied to diatomic gases. L. S. G.

531.19 : 548.7 *see Abstr.* 390

531.383 : 629.135 : 621.34 101

Electrically driven gyroscopes for aircraft. WITHEROW, H. M., AND HANSEN, A., JR. *Trans. Amer. Inst. Elect. Engrs*, 63, *pp.* 204–208, *April*, 1944.—[Abstr. 132 B (1945)].

531.391.3 : 534.11 : 517.942.4 102

Stability of columns and strings under periodically varying forces. LUBKIN, S., AND STOKER, J. J. *Quart. Appl. Math.*, 1, *pp.* 215–236, *Oct.*, 1943.—Problems are considered in elastic systems with infinitely many degrees of freedom. The stability of a column under a periodic compressive axial force $F(t) = P + H\cos\omega t$ is discussed, and it is shown that if P exceeds the Euler load, H and ω can always be chosen to avoid buckling. However, H must be such that $F(t)$ falls below the Euler value for at least part of the cycle, even though the average of $F(t)$ (over a cycle) may be much greater than the Euler load. It is also shown that the column may be unstable when P is compressive and smaller than the Euler load, provided H and ω are properly chosen. The whole analysis is based on the theory of Mathieu equations, the properties of which are summarized. The stability of a stretched string under a periodic tension is also considered. L. S. G.

531.52 103

A modified Atwood machine for use by elementary students. FRIED, K. H., AND MAIS, W. H. *Amer. J. Phys.*, 12, *pp.* 210–212, *Aug.*, 1944.

531.53 104

A simple pendulum energy experiment. BURRIS, A., AND HARGRAVE, W. J. *Amer. J. Phys.*, 12, *pp.* 215–217, *Aug.*, 1944.

531.55 : 623.5 105

Sighting of anti-aircraft guns. CARTER, F. W. *Engineering*, 158, *pp.* 121–122, *Aug.* 18, 1944.—The differential equation of the path of the projectile is solved when the resistance varies as the square of the velocity and when the flight is in still air. The time of flight is found for any range and elevation. A similiar equation is also solved when the projectile moves in a wind. 2 cases are treated: (i) a following wind, (ii) a wind blowing at right angles to the trajectory. L. S. G.

531.7 : 536.41 : 548.0 = 3 *see Abstr.* 383

531.717 : 677 106

Measurement of cloth thickness. *J. Text. Inst., Manchr*, 35, *pp. S1–S6, Sept.*, 1944.—The choice of a dial gauge, rather than a micrometer screw gauge, is dictated by practical experience and the difficulty of obtaining concordant results with the latter type of instrument. The instrument used for measuring cloth thickness under loads of 1 to 10 lb./in.^{2} is described, followed by a discussion of the testing technique. Proposals are given for the testing of narrow fabrics, which represent a step towards the standardization of testing methods for this class of materials, and are divided into 4 types: general dimensional and physical properties; elastic fabrics; chemical tests; tests for colour fastness. H. H. HO.

531.717.1 : 621.317.39 107

Determining the thickness of linings of steel plate. THORNTON, B. M. *Industr. Chem., pp.* 466–468, *Sept.*, 1944.—[Abstr. 101 B (1945)].

531.72 : 533.15 : 539.16.08 = 3 *see Abstr.* 292, 293

531.72 : 541.183 108

The surface area of crystalline egg albumen. SHAW, T. M. *J. Chem. Phys.*, 12, *pp.* 391–392, *Sept.*, 1944.—Experimental details are given. An interpretation of the surface area in terms of average particle size indicates that the average particle dia. calculated from the surface available to N_2 is 2×10^{-4} cm., while that available to water gives 2×10^{-6} cm. It is suggested that this discrepancy might be due to polar layers, for which the assumption is made that water is adsorbed only in the intermolecular polar interfaces. This is compatible with the fact that (*J. Chem. Soc.*, 1935, p. 846) X-ray diffraction photographs for egg albumen show that only the side-chain spacing is affected by water vapour adsorption. H. H. HO.

531.724 109

Surface area of small objects. MORAN, P. A. P. *Nature, Lond.*, 154, *pp.* 490–491, *Oct.* 14, 1944.

531.724 : 541.183 110

Apparatus for surface area measurement. KRIEGER, K. A. *Industr. Engng Chem.* (*Analyt. Edit.*), 16, *pp.* 398–399, *June*, 1944.—Constructional details and method of use of a compact, rapid apparatus for the measurement of surface areas by low-temperature van der Waals adsorption are described.

531.752 111

A vacuum microbalance for the study of chemical reactions on metals. GULBRANSEN, E. A. *Rev. Sci. Instrum.*, 15, *pp.* 201–204, *Aug.*, 1944.—The balance has a sensitivity of $0{\cdot}3 \times 10^{-6}$ g., using a 0·6840 g. sample. The pressure coeff. is $< 0{\cdot}3 \times 10^{-6}$ g. for a 1 atm. change. The temperature coeff. is $0{\cdot}8 \times 10^{-6}$ g./deg. C. change. The zero point of the balance is stable to better than 1×10^{-6} g. over a period of 24 hr. The technique of measurements is discussed. Several typical experiments on the formation of oxide films on iron at 25° C. and 300° C. are described.

531.788 : 621.3.032.11 : 621.317.39 112

Measurement of high vacua. ZIELINSKI, H. H. *Electronics*, 17, *pp.* 112–115, *July*, 1944.—[Abstr. 102 B (1945)].

532.13 113

The viscosity of the methyl ester of dilinoleic acid. YOUNG, D. W., AND BIERTUEMPFEL, R. E. *J. Amer. Chem. Soc.*, 66, *pp.* 843–844, *May*, 1944.—Values are given for the range − 40° to 100°. W. R. A.

532.13 114

Viscosity of water. COE, J. R., AND GODFREY, T. B. *J. Appl. Phys.*, 15, *p.* 625, *Aug.*, 1944.—Modifications of previous apparatus [Abstr. 3962 (1933)] are noted and the results obtained are: Absolute viscosity of H_2O at 20°C. = 1·002 centipoise. The viscosity of H_2O relative to its viscosity at 20°C. has the values 0·8885, 0·7960, 0·6518, at 25°, 30°, 40°, respectively. L. S. G.

532.13 115

Mechanisms for the relaxation theory of viscosity. POWELL, R. E., EYRING, H., ELEY, D. D., AND PEPPER, D. C. *Nature, Lond.*, 154, *pp.* 427–428, *Sept.* 30, 1944.—[See Abstr. 2256 (1944)].—At high stresses, flow velocity approaches linearity with stress. This is characteristic of solid-liquid dispersions, and a theoretical explanation is given. Experiments show that the slope of the straight-line portion of the curve corresponds to a viscosity which is nearly equal to the viscosity of the Newtonian component of the dispersion; and that the temperature coefficient of the flow indicates activation energies which have been otherwise confirmed and involve weak bonds of two types. H. H. HO.

532.13 : 532.14 116

The relative viscosity of aqueous solutions of sulphamic acid and of some of its salts at 25°C. SCHMELZLE, A. F., AND WESTFALL, J. E. *J. Phys. Chem.*, 48, *pp.* 165–168, *July*, 1944.—The relative viscosity and the relative density of solutions of sulphamic acid and of the NH_4, Ba, Ca and Mg salts were studied over the range of the solubility of these substances in water. The results may be expressed by the Jones and Dole equation for fluidities up to 1 normal and by the Root equation for densities over the entire conc. range studied.

532.13 : 676 : 539.24 *see Abstr.* 303

532.133 117

Energy of viscosity as a measure of the cohesion of liquids. GRUNBERG, L., AND NISSAN, A. H. *Nature, Lond.*, 153, *p.* 146, *July* 29, 1944.—The viscosity of a liquid can usually be expressed by: $\eta = A \cdot e^{E\,\mathrm{vlsc.}/RT}$

here η is the viscosity, A is a const. and $E_{visc.}$ is ie energy of viscosity. The energy of viscosity ould equal the work of cohesion for unassociated id non-metallic liquids, and data are given which nfirm the theoretical result. For associated and me polar substances, the energy of viscosity is > the hesional work, the factor connecting the two antities varies between 1·5 and 3·5. By plotting g $E_{visc.}$ against log $1/r$, where r is the separation of ie molecular centres and can approx. be deduced om the molar vol., the slopes of the curves give lues which indicate $E_{visc.}$ to be a measure of the traction between molecules. H. H. HO.

32.133 : 532.14 118

The viscosity of aqueous solutions of electrolytes as a nction of the concentration. VIII. Potassium ferri-anide. JONES, G., AND CHRISTIAN, S. M. *J. Amer. hem. Soc.*, 66, *pp.* 1017–1019, *June*, 1944.—Density id viscosity data are given for aq. $K_3Fe(CN)_6$ up saturation. Equations connecting density, vis-osity and fluidity with conc. are given. $K_3Fe(CN)_6$ olutions verify the predictions of Falkenhagen and ernon [Abstr. 3051, 3052 (1932)]. W. R. A.

32.133 : 539.133 : 541.68 = 3 *see Abstr.* 375

32.133 : 541.64 : 541.24 : 661.713 119

Molecular weight of cellulose. BATTISTA, O. A. *dustr. Engng Chem.* (*Analyt. Edit.*), 16, *pp.* 351–354, *ne*, 1944.—Viscosity/conc. data are given for 5 mples of purified cellulose representing the deg. of olymerization range from 300 to 3 000. On plotting ie data on semilog. paper, linear relationships were ound to exist, in each case, between (1) the viscosity nction $\eta sp/c$ and conc., and (2) the rel. viscosity nction measured at 0·5% conc. and the deg. of poly-erization corresponding to values calculated from iscosity/conc. data extrapolated to infinite dilution. he data are used to derive a mathematical expression y which the value of the viscosity function at the std. onc. of 0·5% may be converted to deg. of polymeriza-on data equivalent to values obtained by extrapola-on of viscosity/conc. data to infinite dilution.

32.137 120

A falling co-axial cylinder viscometer for the rapid easurement of high viscosities. PUGH, H. L. D. *Sci. Instrum.*, 21, *pp.* 177–180, *Oct.*, 1944.—The pparatus consists of an inner hollow brass com-osite cylinder encircled by a brass cylindrical ring ith a space between to contain the test material. etails in design include devices for centring the inner linder during filling and during test; direct application f load to a lower extension from the inner cylinder, hich provides stability to the falling system by en-ring that it remains vertical; and ability of the inner linder to travel an equal distance on either side of ie mean position. The instrument can be filled asily and brought to test temperature in $^1/_2$ hr. nly about 12 cm.^{3} of material are required for test. reasonably wide range of viscosities can be measured y the same apparatus.

32.14 : 532.13 *see Abstr.* 116

32.14 : 532.133 *see Abstr.* 118

32.14 : 535.324 : 532.612 : 541.265 *see Abstr.* 371

532.51 121

Two-dimensional compressible flow past a solid body in unlimited fluid or symmetrically placed in a channel. GOLDSTEIN, S., AND LIGHTHILL, M. J. *Phil. Mag.*, 35, *pp.* 549–568, *Aug.*, 1944.—The Janzen–Rayleigh process for finding the first-order effect of compressibility on the potential flow past a solid body is used and the problem is solved explicitly when the irrotational incompressible flow is known. The mathematics involves conformal mappings and some contour integration. The results are compared with those obtained by the linear perturbation theory and they agree to the first order in the thickness of the body. The special case of a circular cylinder is dealt with and the solution of the general problem for asymmetric flow is briefly considered. L. S. G.

532.51 : 539.385 : 517.945 *see Abstr.* 62

532.522 122

Fluid flow through two orifices in series. II. STUART, M. C., AND YARNALL, D. R. *Trans. Amer. Soc. Mech. Engrs*, 66, *pp.* 387–398, *July*, 1944.—[See Abstr. 3051 B (1936)]. Presents the results of experimental investigations using water at an initial pressure of 100 lb./in^2. from room temperature to saturation. The pressures in the intermediate chamber between the 2 orifices, and the variations of this pressure with ref. to the temp. of water supplied and the type of orifice, are determined. Under certain conditions of flow, the fluid assumes a metastable state. A device responsive to the pressure variations between two orifices in series constitutes a control element.

532.527 123

On the force and moment acting on a body in shear flow. KUO, Y. H. *Quart. Appl. Math.*, 1, *pp.* 273–275, *Oct.*, 1943.—The body is in a steady two-dimensional flow of const. vorticity distribution. Expressions involving the vorticity (k) are derived for the force and moment. These are contour integrals and for $k = 0$ reduce to the well-known Blasius formula for irrotational flow. L. S. G.

532.543 = 6 124

Critical height in surface drains. GANDOLFO, J. S. *Publ. Fac. Cienc. Fis.-Mat. La Plata, No.* 173, *pp.* 517–535, *March*, 1944.—"Critical height" is considered as the determinative factor connecting the hydraulic and geometric conditions of circulation. A series of curves affords an examination of the features governing the conditions of flow with various types of cross-section. R. M.

532.58 125

An application of the method of the acceleration potential. LEHNER, J., AND MARK, C. *Quart. Appl. Math.*, 1, *pp.* 250–261, *Oct.*, 1943.—The pressure distribution on a symmetrical control surface consisting of a fin and a flap separated by a gap of finite width is found by means of Prandtl's theory of the acceleration potential in conjunction with conformal mapping. Steady, irrotational flow is assumed in an incompressible fluid. The equation of motion of this fluid is $\rho \mathbf{a} = -\text{grad } p$ where ρ is the density, p the pressure and $\mathbf{a}$ is the acceleration vector. If $\phi = -p/\rho$ then $\mathbf{a} = \text{grad } \phi$ so that ϕ is conveniently called the acceleration potential. There is a comprehensive mathematical discussion of the

problem and some numerical examples are given. The mappings used are

$$\zeta = \int_0^z \{(1 - x^2)(1 - k^2x^2)\}^{-\frac{1}{2}} dx$$

which maps the slit z-plane on the interior of a rectangle in the ζ-plane and $w = \exp\{\pi(\zeta - K')/K\}$ which takes both horizontal sides of the rectangle into a part of the real w-axis. L. S. G.

532.61.08 126

A new precision method for interfacial tension. WARD, A. F. H.,, and TORDAI, L. *J. Sci. Instrum.*, 21, *pp.* 143–144, *Aug.*, 1944.—The drop-volume method for interfacial tension has been modified to make it a weighing method. The lighter liquid fills a special pyknometer with a cup on the top, into which dips the dropping tip with the denser liquid. The increase of weight of the pyknometer gives directly the weight of a drop less the buoyancy correction for the lighter liquid, the value which is needed for calculation of the interfacial tension.

532.612 : 532.14 : 535.324 : 541.265 *see Abstr.* 371

532.612.4.08 127

The measurement of boundary tension by the pendent-drop method. II. Hydrocarbons. SMITH, G. W. *J. Phys. Chem.*, 48, *pp.* 168–172, *July*, 1944.—Improved technique and apparatus for the precise measurement of boundary tensions by the pendent-drop method are briefly described [see Abstr. 1172 (1941)]. The surface tensions of 15 pure hydrocarbons were measured at 20·0°C. The effects of configuration, mol. wt. and deg. of saturation of the molecule on the surface tensions are indicated for the systems studied.

532.613 128

On the separation of oil from the surface of water. ANTONOFF, G. *J. Phys. Chem.*, 48, *pp.* 173–174, *July*, 1944.—Rotation causes such an increase of the inward pressure and surface tension that the oil which normally spreads on the surface of the water will organize itself into a planetary body. In such cases, the oil can be sucked off by means of a pipette.

532.613.2 : 541.182.025 = 3 *see Abstr.* 365

532.613.4 129

Existence of time-dependence for interfacial tension of solutions. WARD, A. F. H., AND TORDAI, L. *Nature, Lond.*, 153, *pp.* 146–147, *July* 29, 1944.—Interfacial tensions were measured between water and solutions in hexane of long-chain amphipathic substances. Experiments by a precision drop-weight method showed that the interfacial tension varied with time, and continuous readings were made without disturbing the surface. The fall in interfacial tension, which was rapid at first and then slower, reaching an equilibrium value after some days, was much slower than could be explained by diffusion to the surface. The latter, therefore, is followed by a process of high activation energy to produce the final state of the surface film. The rate at which the final interfacial tension is reached increases sharply with rising temperature. Electrolytes alter the interfacial-tension/time variation. By expanding and contracting the pendent drop, the closeness of packing of the molecules adsorbed at the interface was varied and F–A curves obtained. The interfacial films behave like insoluble surface films, since a compression of the film did not drive molecules back into solution. Therefore the activation barrier affects desorption as well as adsorption of molecules.

H. H. HO.

532.614 : 536.655 = 3 130

State of energy and order of atoms in surfaces of liquid and solid substances. HAUL, R. *Z. phys. Chem. B*, 53, *pp.* 331–361, *July*, 1943.—The relations between surface energy and heat of sublimation and evaporation, respectively, are discussed. Liquid rare gases and metals are used as examples for drawing conclusions regarding the configuration of atoms in the surface. The ratio of lat. ht. to surface energy is calculated and found to be > 2 [Abstr. 390 (1942)] but critical remarks are added concerning some of the earlier conclusions. The total surface energy of solid rare gases and of some metals is calculated from the internal heat of sublimation at various temperatures and for different crystal faces. A method is given for estimating the temperature coeff. of the free surface energy. By means of the surface entropy assessed by crystallographic considerations, the free surface energy is calculated as part of the total surface energy. As a reliable method of measuring the surface energy has not so far been found, only an estimate based on theoretical considerations is possible. The methods of measurement are discussed. R. N.

532.614.2.08 : 541.183.2 *see Abstr.* 367

532.62 : 536.655 : 541.183.53 *see Abstr.* 368

532.63 131

Rate of rise of water in capillary tubes. PICKETT, G. *J. Appl. Phys.*, 15, *p.* 623, *Aug.*, 1944.—The writer disagrees with the conclusions reached in a recent paper [Abstr. 2129 (1944)] that the rise of water in a capillary tube produces turbulent flow. A differential equation defining the rate of rise is set up and solved, and it is concluded that the rise is in agreement with a theory that takes into account surface tension, viscosity and density of the fluid, together with the capillary, viscous, gravitation and inertia forces. Turbulence plays no part because the Reynolds number is too low. L. S. G.

532.64 : 591.111.3 : 537.39 *see Abstr.* 251

532.66 : 541.135.5 132

The characterization of capillaries used for dropping-mercury electrodes in polarographic studies. MÜLLER, O. H. *J. Amer. Chem. Soc.*, 66, *pp.* 1019–1023, *June*, 1944.—The radius of the capillary orifice and the capillary const., which is the pressure of Hg (in cm.) necessary to force 1 mg. of Hg through the capillary per sec., are proposed as complete characterization of capillaries used for dropping-Hg electrodes. Various methods for their determination are described which serve as checks for the proper behaviour of the capillary. Some abnormalities in the behaviour of capillaries are discussed. W. R. A.

532.69 : 631.562.3 133

The physical chemistry of flotation. X. The separation of ergot from rye. PLANTE, E. C., AND SUTHERLAND, K. L. *J. Phys. Chem.*, 48, *pp.* 203–223, *July*, 1944.—A successful process for the separation of ergot (*Claviceps purpurae* Tulasne) from rye (*Secale cereale* Linn.) by flotation is described. The alkaloid content of the ergot was unaffected by the treatment.

The variation of stability under surface tension and gravity of an ellipsoid of revolution at an air/water and oil/air interface is examined theoretically. Rye grains approximate to this form and results agree with theory. The attachment of air bubbles to a rye grain was investigated and it was found that bubbles effective in flotation were many times smaller than those expected on theoretical grounds.

532.691 : 676 134

Surface activity and its application to paper. MISKEL, J. J. *Paper Tr. J.*, 118, *TAPPI Sect.*, *pp.* 233–238, 1944.—Anionic surface-active agents (soaps, sulphated and sulphonated oils and aliphatic esters, fatty amide derivatives and aryl-alkyl sulphonates) are used for sizing, cleaning felts, working rags and waste papers, as lubricants in forming cups by pressure in dies, to improve the finish of calendered casein-coated papers, as dispersing and defoaming agents, to give wax- and mildew-resistance, and in packagings for resins and rubber. Cationic types (alkyl amines and their salts, and quaternary ammonium salts) are used as wetting, detergent, deflocculating and emulsifying agents, for fungus control and as aids to sizing with rubber latex and to colouring with basic dyestuffs. Non-ionic types (polyhydroxy alcohol esters, ethylene oxide polymers and polyvinyl alcohol) are used as defoaming agents in sulphite and kraft pulping and in coating processes, to obtain grease resistance and wet strength, as filler adhesives in coatings, and as wetting agents. J. G.

532.695.1 : 541.182.4 135

"Studies in Peat." XIII. Mona wax and its constituents as emulsifying agents. AHERNE, J. C., AND REILLY, J. *Sci. Proc. R. Dublin Soc.*, 23, *pp.* 300–306, *Sept.*, 1944.—[See Abstr. 2132 (1944)]. The nature of the oil is a factor in determining the character of the emulsion formed. With toluene it is possible, following the mode of preparation used, to prepare an emulsion containing more than 81% of dispersed water, using 0·4 g. of wax, per 20 ml. of toluene, as emulsifying agent. The effect of heat on an emulsion of water in liquid paraffin with the wax as emulsifying agent was studied; above 60°C. the breaking which occurs is associated with re-peptization of the film material by the liquid paraffin. The optimum temperature for the preparation of such emulsions lies below 60°C. The effect of the presence, in the water, of certain electrolytes was examined. A solution of sodium oleate gave rise to a multiple system. The components of the wax have different values as emulsifying agents. The constituent which gave the best result was the fraction insoluble in boiling 95% ethyl alcohol.

532.7 136

The liquid state. HILDEBRAND, J. H. *Proc. Phys. Soc. Lond.*, 56, *pp.* 221–239, *July*, 1944.—The Guthrie lecture, in which the author deals mainly with his own contributions to the subject and covers mol. distribution studied by X-ray methods and by entropy of vaporization at the b.p.; solutions where, by mixing different mol. species, knowledge of liquids can be enlarged, are discussed and illustrated by available data. Mathematical and theoretical developments are examined in relation to the experimental work. N. M. B.

532.71 : 536.77 : 678 137

The interaction between rubber and liquids. V. The osmotic pressures of polymer solutions in mixed solvents. GEE, G. *Trans. Faraday Soc.*, 40, *pp.* 463–468, *Oct.*, 1944.—An expression is obtained for the free energy of dilution of a ternary mixture of polymers + two liquids by one of the liquids. This is used to consider the osmotic equilibrium between a solution of a polymer in a mixture of two liquids, and a second phase containing only the two liquids. The osmotic behaviour of the ternary solution is similar to that of a polymer in a single liquid, and van't Hoff's law holds at infinite dilution. The distribution of the two liquids between solvent and solution is calculated.

532.71 : 539.388.8 : 678 138

The interaction between rubber and liquids. VI. Swelling and solubility in mixed liquids. GEE, G. *Trans. Faraday Soc.*, 40, *pp.* 468–480, *Oct.*, 1944.—The equations derived [see Abstr. 137 (1945)] for the osmotic equilibrium between a ternary mixture of polymer + two liquids and a mixture of the two liquids are applied to the swelling of cross-linked polymers in mixed liquids and to the solubility of linear polymers in mixed liquids. A mixed liquid has solvent properties intermediate between those of its constituents only when these mix ideally. The larger the heat of mixing of the liquids, the greater is the solvent power of the mixture relative to those of the components. This conclusion forms the basis of an explanation of the enhanced swelling of rubbers in pairs of dissimilar liquids and of the fact that a mixture of two non-solvents may be a solvent over a certain concentration range. Experimental results are given for the swelling of vulcanized rubbers and the critical solubility limits of unvulcanized rubbers. These can be explained qualitatively from the cohesive-energy densities of the 3 components, and semi-quantitatively from the measured heats of mixing of the 3 binary mixtures.

532.71 = 4 139

Apparatus for the study of osmosis between aqueous and alcoholic phases. CHODAT, F., AND CORTESI, R. *Arch. Sci. Phys. Nat.*, 25, *Sept.–Dec.* (*Suppl. No.* 3, *C.R. Soc. Phys. Hist. Nat. Genève*, 60, 3, *pp.* 233–238), 1943.—The apparatus described allows a comparison of the efficiency of various membranes and an evaluation of the dilutions reached by the adjacent liquids in a given time. The twin cells separated by the membrane are fitted with graduated pipettes for measuring volumes of liquid transferred and stopcock connections for restoring the liquid levels. Illustrative data are given. N. M. B.

532.72 140

Thermal diffusion in liquids. CARR, H. *J. Chem. Phys.*, 12, *p.* 349, *Aug.*, 1944.

532.72 141

Studies in membrane permeability. IV. An improved apparatus for measuring diffusion rates, and the permeability of copper ferrocyanide to eleven solutes. AUSTIN, A. T., HARTUNG, E. J., AND WILLIS, G. M. *Trans. Faraday Soc.*, 40, *pp.* 520–530, *Nov.*, 1944.—[See Abstr. 1645 (1942)]. An improved apparatus for determining the diffusion rates of solutes is described, and its sources of error carefully analysed. The influence of surface charge in determining the

selectivity of $Cu_2Fe(CN)_6$ is shown. Where enhanced selectivity is due to adsorbed $Fe(CN)_6^{-4}$, it may be reduced by reaction of these ions with Cu^{++}. A brief theoretical discussion is given of membrane processes. The diffusion of electrolytes through $Cu_2Fe(CN)_6$ appears to depend upon surface charge on membrane, which may or may not be increased by adsorption of further ions during experiment, valency of anion and diffusion rate in free solution.

532.739 142

Energies of solution of silica in water and HCl. NUTTING, P. G. *J. Chem. Phys.*, 12, *pp.* 347–348, *Aug.*, 1944.

532.739.2 : 541.123.31 *see Abstr.* 333, 334

532.739.2 : 542.61 143

Improved apparatus for solubility determination or for small-scale recrystallization. CRAIG, L. C., AND POST, O. W. *Industr. Engng Chem.* (*Analyt. Edit.*), 16, *pp.* 413–414, *June*, 1944.

532.77 : 537.226.2 *see Abstr.* 238

533.15 : 531.72 : 539.16.08 *see Abstr.* 292, 293

533.6.07 : 621.34 144

High-speed wind tunnel of the Boeing Aircraft Company. *Engineering*, 158, *pp.* 241–242, *Sept.* 29, 1944.—[Abstr. 133 B (1945)].

533.6.08 145

Mine ventilation-air measuring instruments. *Mine Quarry Engng*, *pp.* 215–220, *Sept.*, 1944.—The accuracy of the anemometer deteriorates rapidly for velocities < 150 ft./min. The theory and operation of five other different types of instrument are discussed. Emphasis is laid upon the inter-relationship between the area of the airway and the air velocity and the necessity for obtaining as accurately as possible the value of both. M.-V.

533.691 146

Symmetrical Joukowsky airfoils in shear flow. TSIEN, H. S. *Quart. Appl. Math.*, 1, *pp.* 130–148, *July*, 1943.—The well-known Blasius theorem for calculating the aerodynamic forces acting on an airfoil is generalized and applied to the case of a symmetrical Joukowsky airfoil. The 10 functions that appear in the expressions for the lift and moment coefficients are tabulated for values of the thickness ratio between 0 and 1. The aerodynamic centre position and the coefficient of the moment about this centre are calculated and presented graphically. L. S. G.

533.691.15 147

On the discontinuous flow around an airfoil with flap. KETCHUM, P. W. *Quart. Appl. Math.*, 1, *pp.* 149–167, *July*, 1943.—A method is given for calculating the effect of the wake on the distribution produced by the steady, two-dimensional flow around an airfoil with infinite span and broken line profile. The Schmieden theory (cf. *Luftfahrtforschung*, 17, 1940, pp. 154–160 and 37–44) is applied and the results compared with those obtained from the Kutta–Joukowsky theory. The point where the flow separates from the flap is so determined that the width of the resulting wake approaches zero asymptotically, and this condition leads to zero drag. The pressure distribution along the airfoil, the total lift of the flap and the hinge moment of the flap are determined. L. S. G.

533.7 : 536.7 : 531.19 *see Abstr.* 100

533.75 148

Van der Waals' equation of state and the compressibility of molecules. MACLEOD, D. B. *Trans. Faraday Soc.*, 40, *pp.* 439–447, *Oct.*, 1944.—Van der Waals' equation is investigated on the assumption that b is a function of the total pressure within the fluid. The solution, when applied to a large class of substances, reveals that at the crit. temp. b_c is approx. $= v_c/2$, but it may have any value from $V_c/3$ upwards for actual substances, depending upon their mol. vol. and compressibility. The internal pressures of fluids have been calculated by a simple equation covering both the liquid and vaporous conditions. The value of b undergoes changes of 30% to 40% in passing from the vaporous to the liquid condition. Numerical values, characteristic of particular substances, have been obtained, and these may represent an actual compressibility of the molecule. An explanation is offered for the divergence of RT_c/P_cV_c from the theoretical value of 2·66 for actual substances.

534.014.5 149

Forced vibrations of systems with non-linear restoring force. FRIEDRICHS, K. O., AND STOKER, J. J. *Quart. Appl. Math.*, 1, *pp.* 97–115, *July*, 1943.—Periodic solutions of the equation $\ddot{x} + (\alpha x + \beta x^3) = F\cos\omega t$ are discussed. Such an equation occurs in many non-linear problems, e.g. in electrical problems when the magnetic circuit contains iron. Various iterative methods are given for solving the equation and physical conclusions are drawn from the response curves. The jump phenomena typical of non-linear systems is discussed and also the effect of viscous damping. Questions of stability are treated and there is a section on subharmonic response [solutions where the frequency is ω/n $(n > 1)$]. L. S. G.

534.1 150

On moment-balancing in structural dynamics. GASKELL, R. E. *Quart. Appl. Math.*, 1, *pp.* 237–249, *Oct.*, 1943.—The forced vibrations of beams and frameworks are considered, using the process of moment-balancing already widely used in statical problems. The process converges if the frequency of the forced vibration is smaller than the fundamental frequency of the structure. The dynamic balancing of angle changes is also discussed and examples are given. This process is not always convergent under the above condition of the frequency. L. S. G.

534.11 : 517.942.4 : 531.391.3 = 3 *see Abstr.* 102

534.113 : 536.21 151

Solutions of problems relating to media in contact by the method of wave trains. GREEN, G. *Phil. Mag.*, 35, *pp.* 519–531, *Aug.*, 1944.—The method of wave trains is described [Abstr. 2585 (1930), 79 (1937)] and the summations of wave-train effects are carried out: The results are applied to 3 problems involving the transmission of elastic and temperature vibrations throughout media in contact: (i) 2 elastic rods in contact at the section $x = a$, end $x = 0$ of 1st medium being fixed while end $x = b$ of 2nd medium is free and carries a vibrator of mass M; (ii) rods equal and both ends fixed; (iii) conduction of heat in a uniform rod composed of 2 different materials, 1st medium

tending from $x = 0$ to $x = a$ and 2nd medium om $x = a$ to $x = b$. The whole rod is initially at no temperature and thereafter the end $x = b$ is aintained at const. temperature while the end $x = 0$ maintained at zero temperature. The temperatures any point in either of the media at any instant are termined. L. S. G.

34.115 : 534.22 *see Abstr.* 155

34.121.2 152

A numerical method in the theory of vibrating bodies. AZSONYI, A. *J. Appl. Phys.*, 15, *pp.* 598–606, *Aug.*, 44.—Southwell's relaxation method is used, in conction with Rayleigh's principle, to determine the aracteristic numbers and modes of a vibrating stem. Detailed computations are carried out for e transverse vibrations of a quadrangular elastic embrane, the first and second modes being termined. L. S. G.

34.154 : 616.8 153

An apparatus to be used in recording tremors. ORRIS, A. A. *Arch. Neurol. Psychiat., Chicago*, 49, 123–125, *Jan.*, 1943.—This method utilizes a bber diaphragm over the rim of an ordinary danced-armature loud-speaker. The tremulous nd being placed on the diaphragm, motion is transitted mechanically and produces variation in the uctance of the magnetic path, setting up in the a.c. ils a varying e.m.f. This is amplified and recorded the electromagnetically operated pen. C. J. G.

34.22 154

Demonstration of the Doppler effect. Fox, F. E. *ner. J. Phys.*, 12, *pp.* 228–229, *Aug.*, 1944.

34.22 : 534.115 155

The velocity of sound in vapours. MATTA, K., AND OKHTAR, M. *J. Acoust. Soc. Amer.*, 16, *pp.* 120–2, *Oct.*, 1944.—A form of Kundt's tube is employed which a hot wire records the amplitude in the tionary-wave system. It is calibrated by the use of y air and of oxygen. The results agree with those termined by other methods.

34.22 : 539.382 *see Abstr.* 313

34.7 : 612.85 156

Cochlear microphonics. A critical review. KELLA-AY, P. *Arch. Otolaryng., Chicago*, 39, *pp.* 203–210, *arch*, 1944.—Experimentation (41 refs.) related to e nature and function of the electrical response of e cochlea to acoustic stimuli is reviewed. On the sis of the evidence, cochlear response is regarded as index of hearing, interpretation being limited owing lack of knowledge of central processes. C. J. G.

34.85 157

Aesthetics of sound reproduction. HARTLEY, H. A. *reless World*, 50, *pp.* 198–202, *July, and pp.* 236–9, *Aug.*, 1944.—The author gives reasons for pre-ring the judicious distortion of gramophone or dio reception of music to high-fidelity reproduction the same music. The latter is mere imitation which not artistic. Experiments establish that the keenest joyment is secured by "doctoring" the response rve of the listening set. In this process resonances ust not be present; depressions in the response curve e put in, their width and depth depending on the ects to be achieved. The musical ear is more sensi-e to peaks than to valleys on the response curve. The method of introducing suitable depressions is explained, and details are given of the complete instrument by which a listener could modify the music according to his own taste and understanding. G. E. A.

534.851 158

Gramophone needle buzz. DEVEREUX, F. L. *Wireless World*, 50, *pp.* 290–294, *Oct.*, 1944.—It is shown that buzz is due to an inherent form of distortion arising from the fact that the record is reproduced with a stylus, the shape of which differs from that of the cutter which formed the groove. The standard spherical point is incapable of tracing even a simple sine-wave groove without distortion. The trouble is worse with hill-and-dale recording; this form is used in illustrating the origin of the distortion. A number of possible aids in reducing the buzz are described, with figures and explanatory matter. G. E. A.

535.14 159

On the interaction of radiation and two electrons. HAVAS, P. *Phys. Rev.*, 66, *pp.* 69–76, *Aug.* 1 *and* 15, 1944.—The quantum theory of radiation describes the effect of retardation in the interaction of 2 electrons by the mutual emission and absorption of light quanta. A study was made of a process involving the interaction of 2 electrons and any number of quanta. The number of terms involving virtual quanta needed to describe the retardation in the usual first-order approximation of perturbation theory depends on the number of real quanta involved in the process under consideration. The resulting expression obtained by summing over all the intermediate states involving virtual quanta is of the same form for any process. Møller's formulae for the retarded interaction of 2 electrons with no light quanta and with one light quantum emitted are special cases of the equation obtained.

535.21–31 : 548.0 : 621.794 160

Influence of ultra-violet radiations on the etching of quartz. CHOONG, S. P. *Nature, Lond.*, 154, *pp.* 516–517, *Oct.* 21, 1944.—The quartz plate under investigation is subjected simultaneously to the actions of the corrosive acid and the radiations. The etching cell consists of a short pitch-coated glass tube of which the quartz plate forms the bottom. The radiations come from a condensed discharge between two iron electrodes. They are focused on the base of the cell by a quartz lens. Plates cut in different orientations and plates of amorphous fused silica have been investigated.

535.241.44 : 535.736.12 161

Visual photometry in the region of low brightnesses. GERSHUN, A. *C.R. Acad. Sci. URSS*, 37, 4, *pp.* 125–126, 1942.—A difficulty associated with the visual photometric comparison of small intensities of light arises from the Purkinje effect. The author introduces and defines the concept of "equivalent brightness," as a more representative quantity for practical purposes than real brightness. Conditions in visual photometry which must be fulfilled if the equivalent brightness, as defined, is to be independent of the photometer type, are established. A. E. T.

535.243 162

Photometric method for determination of hemicellulose. BARTON, C. J., AND PRUTTON, A. J.

Industr. Engng Chem. (*Analyt. Edit.*), 16, *pp.* 429–430, *July*, 1944.—A method for the determination of the organic material dissolved in NaOH solutions from wood pulp is presented. A Coleman Universal spectrophotometer was used in developing the method, but it has also been used with two different photoelectric filter photometers. The method is well suited to routine use and determinations can be completed in 5 min.

535.243 : 778.3 163

On plate calibration in spectrographic analysis. LEVY, S. *J. Opt. Soc. Amer.*, 34, *pp.* 447–454, *Aug.*, 1944.—A simplified method of plate calibration is described. It is pointed out that a characteristic curve can be represented very closely by an expression having 1 const. and that a family of curves for varying contrast can be got by changing the const. To obtain the basic curve, several exposures are made on the same plate, using sieves of different mesh numbers as light-weakeners. Two lines of different intensity are chosen and the blackening of these used as steps for the characteristic curve. Results are given showing the applicability of the method. A. H.

535.247.4 : 591.148 164

Factors controlling firefly luminescence. ALEXANDER, R. S. *J. Cell. Comp. Physiol.*, 22, *pp.* 51–71, *Aug.*, 1943.—Normal flashes of the fireflies *Photuris pennsylvanica*, *Photinus scintillans* and *Photinus pyralis* have been recorded photographically, employing an a.c. photocell bridge and a c.r.o. [Abstr. 2066 (1942)]. From experiments here recorded, it seems that the end-cell of the trachiole serves as a mechanical valve which is normally kept closed by the tonic contraction of a contractile ring encircling the trachiole. A flash is produced by the sudden relaxation of this ring together with its active expansion by outer radial contractile elements, thereby admitting oxygen to the photogenic cells. C. J. G.

535.247.4 : 778 : 545.83 165

Ultra-microdetermination of arsenic by Gutzeit spot-filtration under vacuum. SATTERLEE, H. S., AND BLODGETT, G. *Industr. Engng Chem.* (*Analyt. Edit.*), 16, *pp.* 400–407, *June*, 1944.—A relatively rapid procedure and new apparatus are described for the isolation of small amounts of As as AsH_3. A photographic step-scale print, photometrically calibrated, is used to evaluate the spot reactions. A sensitivity of 0·01 μg. of As is claimed. A. H.

535.31 166

On Herzberger's direct method in geometrical optics. SYNGE, J. L. *Quart. Appl. Math.*, 1, *No.* 3, *pp.* 268–272, *Oct.*, 1943.—A powerful technique is obtained by combining the "direct method" [Abstr. 1999, 2000 (1944)] with Hamilton's method. It is shown how the coefficients *A*, *B*, *C*, *D* of the Herzberger transformation may be obtained when Hamilton's angle-characteristic is known for the instrument in question. The case of a single surface (reflecting or refracting) is considered and the problem of the sphere is treated by replacing Herzberger's geometric approach by an analytical method. L. S. G.

535.317 167

Experiments on the six focal lines due to reflections at the surfaces of two plano-cylindrical lenses. SEARLE, G. F. C. *Phil. Mag.*, 35, *pp.* 477–491, *July*, 1944.—The lenses are placed with their plane faces parallel and their convex surfaces in contact. The optics of the lens system, including the principal curvatures and the focal lines, are studied. The effects, on the position and direction of the focal lines, of the angle between the axes of the lenses are studied and experiments illustrating the theory are described. With monochromatic light, elliptical Newton's rings are produced by reflection and these are used to find the radius of the cylinders. A numerical example is given. L. S. G.

535.317 168

Vignetting. WYNNE, C. G. *Proc. Phys. Soc., Lond.*, 56, *pp.* 366–371, *Nov.*, 1944.—The variation of effective pupil area with the obliquity to the axis of the incident light in photographic lenses depends on the position and size of the vignetting stops. This is investigated, and the possibilities outlined of choosing vignetting stops in a lens to give the pupil area variation best suited to the angular aberration distribution.

535.321 : 545.844 169

Adsorption analysis of colourless compounds: method and application to the resolution of stearic and oleic acids. DUTTON, H. J. *J. Phys. Chem.*, 48, *pp.* 179–186, *July*, 1944.—A method for the adsorption analysis of colourless compounds is described which employs a highly sensitive differential refractometer modified for measurement of changes in the refr. index of percolates from adsorption columns during continuous flow. The resolution of stearic and oleic acids was studied as an example of the application of this general method. Advantages and limitations of the method are discussed.

535.324 : 532.612 : 532.14 : 541.265 *see Abstr.* 371

535.324 : 541.654 170

The refractive indices of some binary hydrocarbon mixtures. HERINGTON, E. F. G. *Trans. Faraday Soc.* 40, *pp.* 481–487, *Nov.*, 1944.—The refractive indices of 15 binary hydrocarbon mixtures made up from cyclohexene, aromatic and naphthenic hydrocarbons were measured at 20°C. with an Abbé refractometer (prob. error $\pm$ 0·0003 units) and compared with the values calculated on a volume-additive basis. Nine of the systems show deviations outside experimental error. In eight cases the observed refr. index is $<$ the calculated, while in the other the deviation is in the reverse sense. Evidence for some form of quasi orderly array in the pure components is reviewed, and it is suggested that the deviations from the calculated refr. indices of the mixtures result because the mixtures are generally less ordered than the pure components. The reverse condition may occasionally arise (the one exception quoted above). The experimental results are discussed from this point of view.

535.33 : 665.5 17

Spectral methods and their application in the petroleum industry. NAYLOR, W. H. *J. Inst. Petrol.*, 30, *pp.* 256–265, *Sept.*, 1944.—A survey article which indicates the use of X-rays on the constructional side (weld checking), and for following changes in catalyst structure. Emission spectra are used for engine-wear studies, detection of impurities in crude oil and catalysts, for the analysis of cores, soil and water in oil fields, and for correlating geological strata. Infrared absorption spectra are used for analysis of hydro

rbon mixtures and for automatic process control. man spectra are used for analytical purposes, the alysis of gasolene components and paraffins. A. H.

5.33.03 172

A spectrographic method for small amounts of icium in magnesium metal. WHITEHEAD, T., JR., D BOYLE, A. J. *Industr. Engng. Chem.* (*Analyt. lit.*), 16, *pp.* 455–456, *July*, 1944.—A successful ectrographic procedure is described for the deter- nation of low-percentage Ca in Mg metal using v. spark excitation. Ca is determined in amounts m 0·0005% to 0·1%. Extrapolation of curves tained by a Ca addition method gave results from ich are established working curves for the direct ectrographic analysis of metallic Mg.

5.33.03 173

Spectrographic determination of trace elements in)/30 brass and admiralty brass. I. LEICHTLE, P. A. *Opt. Soc. Amer.*, 34, *pp.* 454–463, *Aug.*, 1944.—A ectrographic procedure for the simultaneous deter- ination of Pb, Fe, Ni, Sn, Bi, and Sb in 70/30 brass d admiralty brass is described in detail. The source a 14 A l.v. d.c. arc of conventional type. A 50 mg. llet sample is arced to extinction in a cupped graphite ectrode of specified dimensions. The intermediate ode of illumination obtained by focusing the source the collimator lens is used. A radial sector disc aced at the slit is used to regulate the effective ex- osure at the plate. The step sector method of plate alibration is used. The source for the calibration a 4 A d.c. arc on $^3/_{16}$ in. dia. Cu electrodes. The alibration curve on the Cu line 2 882·934 Å is used or a wavelength region 2 590 Å–3 100 Å. The Cu f. line of 2 858·734 Å is chosen for comparison with e respective impurity lines. Working curves are ven for the determination of Pb, Fe, Ni, Sn and Sb the range of 0·01–0·10% and Bi in the range of ·0004–0·010%.

5.331.03 : 621.325.1 174

A universal source of excitation of spectra. SVEN- TSKY, N. S. *C.R. Acad. Sci. URSS*, 37, 7–8, *pp.* 205–08, 1942.—Describes circuit arrangements for the citation of either the arc or the spark spectral lines, articularly for use in the industrial spectrum analysis metals and alloys. The device consists of a basic rcuit for producing an arc discharge at industrial equency, into which h.f. currents are fed under con- ollable conditions from an auxiliary circuit. To roduce arc spectral lines, with avoidance of injurious urning of the electrodes, the burning time of the arc interrupted by a simple rotating interrupter in the f. circuit. Conditions for the spark régime are ecured when the duration of the arc flashes is reduced y appropriate variation of the circuit parameters of oth basic and h.f. circuits, and at the same time the rc gap is shunted by a capacitor. A. E. T.

35.338 : 537.531 *see Abstr.* 258

35.338.4 175

Rotational analysis of ultra-violet bands of silicon ionosulphide. BARROW, R. F. *Nature, Lond.*, 154, *p.* 364–365, *Sept.* 16, 1944.

35.338.41 176

Lifetimes of resonance lines of cadmium. WEBB, I. W., AND MESSENGER, H. A. *Phys. Rev.*, 66, *p.* 77–86, *Aug.* 1 *and* 15, 1944.—The mean lifetime of the triplet resonance line 5^1S_0–5^3P_1, 3 261 Å, was measured by the alternating-voltage method. The value found was $2{\cdot}14 \times 10^{-6}$ sec., with an estimated precision of 3%. Similar measurements of the singlet resonance line, 5^1S_0–5^1P_1, 2 288 Å, showed that the excitation which resulted in the emission of this line was mainly due to cascading from a higher level (or levels) by infra-red transitions, the excitation to the 5^1P_1 level by electron impact being less probable than that to the higher level. The lifetime of the infra-red transition is $9{\cdot}0 \times 10^{-9}$ sec. From the form of the curve showing the dependence of the persistence of the radiation emitted by the excitation tube upon the vapour conc., the mean lifetime of the 2 288 Å transition was estimated as approx. $2{\cdot}1 \times 10^{-9}$ sec. The lifetime of the subordinate series lines 5 086–4 800–4 678 Å is 10^{-7} sec., but since the measurements were affected by absorption and re-emission of the radiation, this value can be taken only as the max. possible value. For the diffuse subordinate series lines, 5^3P–5^3D, similar measurements showed that their lifetime was $> 10^{-7}$ sec.

535.34 : 537.531 *see Abstr.* 259

535.341 = 690 177

Determination of the coefficient of absorption of light in cells. GONÇALVES, J. M. *Rev. Brasil. Biol.*, 4, *pp.* 125–130, *April*, 1944.—Simultaneous absorption and diffusion make spectrophotometrical measurements in cells and turbid solutions difficult. From experiments here described it is possible to determine the coefficients of diffusion and absorption in turbid media by measuring the opacity for 2 different layers. Using a suspension of yeast cells, it is shown that the method may be useful in a quantitative study of intracellular pigments. The apparatus consisted of a source of radiation, a Leitz monochromator and a photo-electric resistance cell, combined with a Leeds and Northrup galvanometer. C. J. G.

535.342 : 541.124 *see Abstr.* 338

535.343–1 178

Further studies of the infra-red absorption of rubber. WILLIAMS, D., AND DALE, B. *J. Appl. Phys.*, 15, *pp.* 585–591, *Aug.*, 1944.—The transmission spectrum of natural rubber is studied in the region 1 μ to 15 μ. The rubber samples were cut from sheets of vulcanized rubber (of low sulphur content) and the thickness of the unstretched samples was 0·03–0·07 mm. Both linear and radial stretch produce an increase in the absorption coefficient. The changes are greatest at short wavelengths. Linear extension greater than 400% of the original length produces an increase in the C–C vibrational frequency. The results are interpreted in terms of recent theories of rubber structure [Abstr. 2869 (1942), 257 (1944)]. L. S. G.

535.343–31 : 541.65 179

Relationship between unsaturation and the ultra-violet absorption spectra of various fats and fatty acids. BARNES, R. H., RUSOFF, I. I., MILLER, E. S., AND BURR, G. O. *Industr. Engng Chem.* (*Analyt. Edit.*), 16, *pp.* 385–386, *June*, 1944.—The spectral absorption of several unsaturated fatty acids and natural fats have been measured from 2 500 to 2 100 Å. Data are presented that show a definite relationship between the deg. of unsaturation and extinction coefficients at

2 100 Å. From the composition of natural fats it is possible to predict the extent of absorption at this wavelength.

535.343.4 : 536.666 : 541.124.7 *see Abstr.* 344

535.343.4–31 180

The spectrum of deuteroacetone in the vacuum ultra-violet. A comparison with the spectrum of acetone. LAWSON, M., AND DUNCAN, A. B. F. *J. Chem. Phys.*, 12, *pp.* 329–335, *Aug.*, 1944.—The spectrum of acetone-d_6 of over 90% purity was photographed in the region 2 000–1 300 Å, with a dispersion of 4·14 Å per mm. Data for the transition at about 51 000 cm.$^{-1}$ are presented together with new data on acetone in the same region. A discussion of the normal state of the acetones is given, and an analysis is made of the electronic spectra. No vibrational frequency near 1 200 cm.$^{-1}$ appears in the excited state of acetone-d_6 and this frequency cannot be ascribed to the C–O vibration.

535.371 181

List of fluorescent minerals. WARREN, T. S. *Min. Mag.*, 34, *pp.* 342–343, *and pp.* 363 *and* 364, *July*, 1944.

535.371 : 622 182

Fluorescence aids mining. PLUMB, H. T. *Elect. Engng, N.Y.*, 63, *pp.* 243–246, *July*, 1944.

535.371 : 667.2 : 535.54 *see Abstr.* 188

535.375.51 183

Depolarization of Raman lines. A further simplification of method. GLOCKLER, G., HASKIN, J. F., AND PATTERSON, C. C. *J. Chem. Phys.*, 12, *p.* 349, *Aug.*, 1944.—[See Abstr. 170 (1944)].

535.393 184

Optical constants of tungsten and antimony determined by reflected polarized light. CHATTERJEE, L. M., AND PRASAD, K. N. *Curr. Sci.*, 13, *pp.* 177–178, *July*, 1944.—This note gives the optical constants for Sb and W over the range 4 600 Å to 6 600 Å as determined by Drude's method using reflected polarized light. The effect of polishing is also discussed. A. H.

535.417 : 536.413.2 185

Interferometer measurements on the expansion of iron. SAUNDERS, J. B. *J. Res. Nat. Bur. Stand., Wash.*, 38, *pp.* 75–86, *Aug.*, 1944.—Several sets of data, taken on relatively pure Fe by different observers and different procedures, are compared. The results show agreement between data taken with those interferometer methods that are free from tilting of spacers and air-film errors, whereas the failure to eliminate these two errors produces data that cannot be duplicated except by chance. The interferometer data that are free from these errors agree with data obtained by other precision methods. Some investigators claim to have found indications of a characteristic temperature effect in the expansivity curve of iron in the temperature range from 0° to 250°C. When the expansion data are freed from errors of tilting and changes in air films, the indications of such effects do not appear.

535.43 : 551.481.1 *see Abstr.* 403

535.435 186

Interferometric studies of light-scattering in binary liquid mixtures. II. BAI, K. S. *Proc. Indian Acad. Sci.* '*A*, 20, *pp.* 18–23, *July*, 1944.—The scattering of light by 7 PhOH–H_2O mixtures was examined spectro-interferometrically [see Abstr. 892 (1944)]. For mixtures containing 15, 28, 34 and 60 wt.% PhOH, Brillouin components are absent, indicating the presence of large mol. clusters, whilst in mixtures containing 10, 70 and 80 wt.% PhOH Brillouin components are present, weakly at 80°C. and more pronounced at higher temp. indicating the breaking up of large clusters to smaller groups. The tendency to form mol. clusters was greatest at the crit. composition, in agreement with other optical data. W. R. A.

535.51 : 620.179.16 18

Rapid determinations of elastic constants of glass and other transparent substances. SZYMANOWSKI, W. T. *J. Appl. Phys.*, 15, *p.* 627, *Aug.*, 1944.—[Abstr. 11 B (1945)].

535.54 : 535.371 : 667.2 = 3 18

On lengthwise polarized fluorescence of fibre-dyeing. ZIEGENSPECK, H. *Kolloidzschr.*, 106, *pp.* 62–64, *Jan.* 1944.—What is claimed to be the first proof of total fluorescence polarization is obtained by dyeing ramie fibres with fluorochromes in such a manner that the particles of the dyestuff are ordered on the micellæ of the fibre so that their respective longest dimensions lie parallel. By applying grazing beams of light polarization in the direction of fibres and dyestuff particles occurs with basic as well as with acid dyestuffs. R. N.

535.56 : 541.653 189

Optical rotation as an indication of aromatic substituent influences and intramolecular interaction. PIGMAN, W. W. *J. Res. Nat. Bur. Stand., Wash.*, 33, *pp.* 129–144, *Aug.*, 1944.—As a result of a comparison of the rotations of certain aromatic β-glucosides and their tetra-acetates, it is probable that the rotations of the acetylated glucosides are influenced by steric interactions between the aglycon group and the sugar portion of the molecule. This is in contrast to the influences predominating in the case of the unacetylated compounds which probably operate on the resonance of the aglycon aromatic ring or in an inductive fashion. The rotation of several β-glucosides in nitrobenzene solution was measured from 20° to 150°C. In particular, those which show anomalous pos. rotations at room temperature, exhibit a change in sign of rotation from + to −.

535.6 : 159.93 190

Psychophysics of colour. *J. Opt. Soc. Amer.*, 34, *pp.* 245–266, *May*, 1944.—This paper is to form Chap. VI of the Colorimetry Report of the Optical Soc. of America [see Abstr. 1994 (1944)]. Colour is defined as consisting of those characteristics of light which can be specified in terms of (i) the appropriate photometric quantity, (ii) dominant wavelength and (iii) purity. The last two define the chromaticity of light. Since photometric quantity is one of the colour characteristics of light, photometry is included in colorimetry. The various photometric quantities are defined, and an explanation is given of the different quantities and procedures involved in the measurement of chromaticity. J. W. T. W.

535.653.3 : 676 191

Colour measurement for control and research in paper-making. EDGE, S. R. H., AND MCKENZIE, H. M. *Proc. Tech. Sect. Paper Mkrs' Assoc.*, 24,

201–211, 1943.—Comparative trichromatic coeff. nd brightness measurements are tabulated for 6 apers of various shades of white, obtained with the ilger Blancometer and with the Hardy recording ectrophotometer. The agreement between the 2 in- ruments is good. Comparisons of papers of similar olours are facilitated by comparing the mean tones nd colour factors. The former is the average re- ctivity of the paper using the red, green and blue ters; it represents the general reflectivity of the mple better than does the reflectivity in white light, though the 2 figures are seldom very different. The olour factor is the arithmetic mean of the differences etween the reflectivities with each of the 3 filters and e mean tone; for a neutral shade it is zero, and with epartures from the neutral which are all of the same ade, it expresses the relative intensity of the colour. pplications of the Blancometer to matching the ades of paper and paper-colouring matters, to easuring the fastness to light of paper, and to the ecording of colour standards for pulp and paper, are escribed. Each instrument requires separate cali- ration, a very steady supply of mains electricity is ecessary to operate it, and the h.t. batteries need equent checking. J. G.

535.668.1 192

Determination of the dry hiding of pigmented coat- ngs. GORDON, P. L., AND GILDON, M. A. *Industr. ngng Chem.* (*Analyt. Edit.*), 16, *pp.* 442–446, *July*, 944.—An empirical equation expressing the relation- hip between the contrast ratio of a dry pigmented oating and the weight of material applied is developed y rectification of the dry hiding curve, using the nethod of averages. The equation applies to 4 un- elated paints, and furnishes the means for calculating he dry hiding at any desired contrast ratio. The nethod yields reproducible results, provides the pportunity for neutralization of errors introduced by aulty technique, and will also function where high dry iding pigments are used. Theoretical and practical nterpretations of the data and comparisons are iscussed.

535.7 : 612.84 193

A universal apparatus for research in physiological optics. BROWN, C. R. *J. Exp. Psychol.*, 33, *pp.* 340–349, 1943. *Abstr. in Biol. Abstr.*, 18, 6061, *April*, 1944.—The apparatus was designed to provide a common matrix for the greatest possible variety of research in physiological optics, such as studies of simultaneous contrast, Fechner–Benham colours, inter-ocular discrimination, some aspects of stereo- scopic vision, and adaptation. The apparatus pro- vides an independently controllable field of vision in each eye; each field of vision (18°) is divisible into subregions of independently controllable luminosities. Episcotisters provide for intermittence of illumination of any desired frequency, and any desired phase relation between subregions. There is also provision for blurring of the field of vision to various known degrees by a method which obviates compensation by accommodatory readjustment. C. J. G.

535.7 : 612.84 194

Dark-adaptation: some physical, physiological, clinical and aeromedical considerations. SHEARD, C. *J. Opt. Soc. Amer.*, 34, *pp.* 464–508, *Aug.*, 1944.—A description of the phenomena and underlying facts of dark-adaptation followed by an account of the author's method of measuring it. The results of some investigations are given, including a study of the use of red goggles for adapting. Clinical conditions are considered, especially the effects of avitaminosis and anoxia. The effects of certain pathological conditions producing vitamin-A deficiency and the use of drugs and ingested substances as regards dark-adaptation are described. J. W. T. W.

535.733.1 195

Monochromatism. PITT, F. H. G. *Nature, Lond.*, 154, *pp.* 466–468, *Oct.* 7, 1944.—Monochromatism, in which any colour can be matched with any other colour by adjustment of intensity, is frequently due to absence of cones in the retina. In rare cases, however, it may be due either to a combination of protanopia (absence of red sensation) with tritanopia (absence of blue sensation) or to a combination of tritanopia with deuteranopia (fusing of red and green sensations). In either case the estimated frequency of occurrence is about 1 in 100 millions. The colour vision of an actual monochromat is described. J. W. T. W.

535.735 : 612.84 196

Energy, quanta, and vision. HECHT, S., SHLAER, S., AND PIRENNE, M. H. *J. Gen. Physiol.*, 25, *pp.* 819–840, *July*, 1942.—An optical measuring system and a shutter are described and illustrated. The eye at the pupil fixates the red point and observes the test field formed by a lens and diaphragm. The light for this field comes from a lamp through the neutral filter and wedge, through the double monochromator, and is controlled by a shutter for obtaining a single exposure of 0·001 sec. The measurements, reflections and absorptions, the Poisson distributions, the frequency of seeing and the physical fluctuation and biological variation, are discussed. The results clarify the nature of the fluctuations shown by an organism in response to a stimulus. C. J. G.

535.736 197

Visual acuity and visual tasks. LUCKIESH, M. *Illum. Engng, N.Y.*, 39, *pp.* 415–433, *July*, 1944.—The usual method of testing visual acuity with a chart of the Snellen type is described and the effects of illu- mination and of the contrast between the letters and their background is examined. Visual acuity is only one of the factors which affect the visual efficiency of persons performing a vast variety of tasks. A special form of illuminator for test-charts is described. J. W. T. W.

535.736.12 : 535.241.44 *see Abstr.* 161

535.823.3 198

Tube-length in photomicrography. BAKER, J. R. *J. R. Micr. Soc.*, 62, *pp.* 112–115, *Sept.–Dec.*, 1942.—Focusing in photomicrography should be achieved by extending the draw-tube, the other adjust- ments of the microscope being left exactly as they were during visual observation. The amount of extension necessary depend wholly on the eyepiece, and once it is known the ground-glass may be discarded. On passing from visual work to photomicrography, the tube is simply extended by the amount which the eye- piece is known to require. This method gives critical images at all magnifications. C. J. G.

535.824 : 778.31 199

Increasing the depth of focus in photomicrography by incident light. KOCH, W. *J. R. Micr. Soc.*, 61, *pp.* 86–87, *Sept.–Dec.*, 1941.—A set of 3 circular thin plates with a central hole is used. The external dia. = the dia. of the fixed diaphragm of the object glass. The dia. of the holes are 1, 2 and 3 mm. respectively. The stops are either put direct on the object glass diaphragm or fastened to an intermediate piece which guarantees the exact central position of the aperture of the stop. The choice of the right stop is determined by the wanted depth of focus and necessary resolving power. To determine the most suitable aperture of the stop, a stage micrometer is photographed in transmitted light. This allows the increasing depth of focus and a very close estimate of the loss of resolving power to be measured. The effects on the depth of focus and resolving power are discussed. C. J. G.

535.826.1 200

The ripening of Ehrlich's haematoxylin. WATSON, J. M. *J. R. Micr. Soc.*, 63, *pp.* 20–25; *suppl. note, p.* 121, 1943.—Experiments are described to determine a suitable method of ripening solutions of Ehrlich's haematoxylin artificially, so that it might be used at once instead of waiting for the usual exposure to light and air. The results, and the mechanism of ripening and over-ripening, are discussed. C. J. G.

535.826.1 201

Synthetic mounting medium of high refractive index. FLEMING, W. D. *J. R. Micr. Soc.*, 63, *pp.* 34–37, *March–June*, 1943.—Details of the synthesis of a resin of refractive index N_d 1·7–1·8 are given. The visibility of diatoms in this medium will be ∝ the greater difference of at least 1·7–1·4; a worthwhile gain. The resin is marketed under the name *Naphrax*, U.S. Pat. 2,312,329, 1943. C. J. G.

535.826.3 202

A fluid for softening tissues embedded in paraffin wax. BAKER, J. R. *J. R. Micr. Soc.*, 61, *pp.* 75–78, *Sept.–Dec.*, 1941.—When tissues embedded in paraffin wax are brittle or crumbly, they may be soaked in a solution of alcohol (60%) 90 cm.^{3} and glycerine 10 cm.^{3}. This penetrates if the wax is cut at one side to expose the tissue at the surface. C. J. G.

535.826.7 203

On Chlorazol Black E and some other new stains. CANNON, H. G. *J. R. Micr. Soc.*, 61, *pp.* 88–94, *Sept.–Dec.*, 1941.—The use and effects of eight stains and two combinations are discussed. C. J. G.

535.826.7 204

Nucleolar staining method applied to animal tissues. BHADURI, P. N., AND SEMMENS, C. S. *J. R. Micr. Soc.*, 62, *pp.* 21–24, *March–June*, 1942.—In view of the observed superiority of the specific nucleolar staining method an attempt has now been made to apply it more specifically to animal tissues, where outstanding problems in connection with the hereditary behaviour of the nucleolus are urgently in need of solution. The technique is described. C. J. G.

535.826.7 205

Further uses for Chlorazol Black E and a new stain for botanical sections. ARMITAGE, F. D. *J. R. Micr. Soc.*, 63, *pp.* 14–19, *March–June*, 1943.—The use of Chlorazol Black E as a stain for microfungi and for paper fibres, and of Chlorazol Azurine G 200 as a botanical stain is discussed. $MgSO_4$ has been used successfully for obtaining max. dispersity of the dyes. C. J. G.

536.2 : 631.563.2 206

Heat and vapour transfer in the dehydration of prunes. PERRY, R. L. *Trans. Amer. Soc. Mech. Engrs*, 66, *pp.* 447–456, *July*, 1944.—To determine the actual temperatures of prunes during dehydration, readings were made by thermocouples inserted at different points in prunes for 3 test runs at about 166°F. and rel. humidities of 15, 27 and 43%. Surface thermal conductances were computed. The vapour conductance at the surface was estimated from the thermal conductance, by employing the heat-mass transfer analogy. From the vapour conductance and the evaporation rate, the difference in vapour conc. required to move vapour from the prune surface to the air stream was calculated. Moisture movement within the prune was investigated by cutting the flesh of samples, removed after 3, 6, 10 and 16 hr. drying, into 2 parts, that near the surface, and that near the pit.

536.2.01 207

An approximate method for calculating heat flow in an infinite medium heated by a cylinder. WHITEHEAD, S. *Proc. Phys. Soc., Lond.*, 56, *pp.* 357–366, *Nov.*, 1944.—An approximate equation is given for the solution of the rapidly heated or naturally cooled long highly conducting cylinder in a conducting medium. The range of validity and accuracy of the approximation are indicated. The analogy with a loaded transmission line is shown, by which is illustrated the different types of solution according to the magnitude of the ratio of the effective heat of the cylinder to the specific heat of the medium. Some formulae for the rapid computation over certain ranges of the error integral with a complex argument are given.

536.2.01 : 517.544.2 *see Abstr.* 53

536.21 : 534.113 *see Abstr.* 151

536.33 : 530.12 208

A relativistic theory of temperature radiation. DINGLE, H. *Phil. Mag.*, 35, *pp.* 499–518, *Aug.*, 1944.—The theory starts by regarding the temperature (T) as a time rate of change of a quantity η (closely related to the entropy change of the radiating body) and both η and time are measured by strictly defined thermal processes. The analogy between motion and temperature is emphasized. T is measured relative to an arbitrary zero and temperature radiation does not involve the concept of interchange of radiation between bodies at the same temperature, since such radiation, like absolute motion, is unobservable. Transformation equations are found for use when the zero of T is changed and a thermal "interval" invariant under such transformations is derived. The geometric aspects of temperature radiation are dealt with and the physical meaning of the concepts employed is discussed. L. S. G.

536.4/.7 209

Thermodynamic properties of *cis*-2-butene from 15° to 1 500°K. SCOTT, R. B., FERGUSON, W. J., AND BRICKWEDDE, F. G. *J. Res. Nat. Bur. Stand.*,

Wash., 33, *pp.* 1–20, *July*, 1944.—The following properties of a sample of *cis*-2-butene, 99·94% pure, were measured: the sp. ht. of solid and of liquid from 15° to 300°K., heat of fusion at the triple point (130·25 int. joule g^{-1}), triple-point temperature (— 138·900 ± 0·008°C.), ht. of vap. at several temperatures betw. 246° and 293°K., and v.p. from 200° to 296°K. With these experimental data, calculations were made of the normal b.p. (3·718°C.), vol. of the saturated vapour, enthalpy and entropy of the solid and the liquid from 0° to 300°K., and entropy, enthalpy and sp. ht. of the vapour in the ideal gas state from 245° to 300°K. Thermodynamic functions for *cis*-2-butene in the ideal gas state from 300° to 1 500°K. were calculated from spectroscopic data. Thermodynamic data for the *cis-trans* isomerization of 2-butene are included.

536.41 : 531.7 : 548.0 = 3 *see Abstr.* 383

536.413 : 539.389.4 210

On the expansion hysteresis of invar. BENEDICKS, C., AND SEDERHOLM, P. *Ark. Mat. Astr. Fys.*, 29*A*, 1, *No.* 6, 15 *pp.*, 1943.—An experimental study. 4 methods of measurement are described and the registration results show an obvious hysteresis which is in the same direction as in all previous observations. The magnification of the microcator used was 2 500.

L. S. G.

536.413.2 : 535.417 *see Abstr.* 185

536.413.3 : 549.211 211

Thermal expansion of diamond. KRISHNAN, R. S. *Nature, Lond.*, 154, *pp.* 486–487, *Oct.* 14, 1944.—The change in the lattice spacing of diamond with temperature has been measured over the range 25° to 650°C., using a sensitive method in which a divergent beam of X-rays from a Cu target is reflected on to a photographic film 80 cm. distant. Dembowska's earlier data at low temperatures had been quoted as indicating a constant value for the Grüneisen number, γ, but from the present values for the expansion coefficient and the sp. ht. data of Magnus and Hodler, it seems that as the temperature is raised, γ increases steadily from about 1·1 to 1·32 and then decreases.

R. W. P.

536.421.1 212

Mechanically stirred melting-point apparatus. DEDMAN, A. J. *J. Sci. Instrum.*, 21, *pp.* 185–186, *Oct.*, 1944.

536.421.1 : 541.123.2 *see Abstr.* 330

536.421.1 = 3 213

The fusion diagram of picrylchloride: trinitrotoluene. KOFLER, A., AND BRANDSTÄTTER, M. *Z. phys. Chem.*, 192, *pp.* 60–70, *July*, 1943.—[See Abstr. 696 (1932), 4332 (1933)]. It is found [Abstr. 1444 (1943)] that in a contact preparation of trinitrochlorobenzene and trinitrotoluene, 2 series of mixed crystals are produced, one of them having the structural type of the stable trinitrotoluene, the other one that of the instable trinitrochlorobenzene melting at 61°C. R. N.

536.423 : 541.127 *see Abstr.* 347

536.423.15 : 536.655 : 536.75 214

Vapour pressures, heats of vaporization, and entropies of some alkali halides. ZIMM, B. H., AND MAYER, J. E. *J. Chem. Phys.*, 12, *pp.* 362–369, *Sept.*, 1944.—V.p. of crystalline KCl, KBr, KI and NaCl were measured in the range 10^{-1} to 10^{-7} mm. by a surface ionization method. Heats and entropies of vaporization, heats of vap. at 0°K. and entropies at 298°K. are calculated. Saturated KCl vapour is less than 2% associated at 800°K. and the heat of dissociation of $(KCl)_2$ is < 47 kcal.

536.468 : 676 215

Flammability of treated paper and paperboard. *Paper Tr. J.*, 119, *TAPPI Sect.*, *p.* 39, 1944.—A revision of TAPPI Suggested Method T461 sm-43. The specimen strip (not more than $^1/_{16}$ in. thick) is clamped in a metal frame so as to leave an area 2 in. × 8·25 in. exposed, and is held with the longer edge vertical. A Bunsen flame (height 1·5 in. with the air inlet closed, internal dia. $^3/_8$ in.) is applied, so that the top of the burner is 0·75 in. below the centre of the lower edge of the paper, for 12 sec. The time of glow after withdrawal, and the height that is charred to such an extent that it will separate readily between the thumb and forefinger, are measured. Strips cut in each direction of the sheet are tested. In general, the flameproofing treatment is ineffective if the char length is less than 5 in. J. G.

536.531 : 621.317.39 216

Electronic thermometer. WEILLER, P. G., AND BLATZ, I. H. *Electronics*, 17, *pp.* 138–139 *and* 362–363, *July*, 1944.—[Abstr. 103 B (1945)].

536.532 217

Thermocouple wire fitment bending jig. DRURY. G. W. *J. Sci. Instrum.*, 21, *p.* 186, *Oct.*, 1944.

536.532 : 536.621 218

A thermopile for microcalorimetry. MASON, L. S. *Rev. Sci. Instrum.*, 15, *pp.* 205–207, *Aug.*, 1944.—A thermopile is described, using constantan-Chromel-P couples mounted in a sheet of Micarta, and electrically insulated with a Vinylite resin which has an insulation resistance > 25 MΩ. The thermopile consists of 2 sections of equal numbers of junctions which are connected in parallel to a galvanometer in series. At a scale distance of 9 m. the sensitivity of the system is 0·25 μdeg./mm. The heat conductivity const. of the calorimeter is 0·004 $min.^{-1}$ and that of the thermopile is 0·03 $min.^{-1}$.

536.58 219

"Temp-turb" temperature-control system. CAMPBELL, J. R. *Trans. Amer. Soc. Mech. Engrs*, 66, *pp.* 439–441, *July*, 1944.—A turbine wheel, the blades of which change their position with temperature changes, has all, or a sample, of the flowing fluid passed through it. Direction of rotation, rate of rotation, and torque output are a function of temperature when fluid-flow rate is const. Power available from the turbine wheel actuates the valves which determine the fluid temperature.

536.6 : 536.75 220

High-temperature heat contents of magnesium nitrate, calcium nitrate and barium nitrate. SHOMATE, C. H. *J. Amer. Chem. Soc.*, 66, *pp.* 928–929, *June*, 1944.—Measurements on $Mg(NO_3)_2$ (399°–623°K.), $Ca(NO_3)_2$ (403°–815°K.) and $Ba(NO_3)_2$ (411°–862°K.) are used to derive equations for heat content and C_p and values of entropy for 50 deg. intervals from 350° K. W. R. A.

536.6/.7 : 678 221

Specific heat and increases of entropy and enthalpy of the synthetic rubber GR-S from 0° to 330°K. RANDS, R. D., JR., FERGUSON, W. J., AND PRATHER, J. L. *J. Res. Nat. Bur. Stand., Wash.*, 33, *pp.* 63–70, *July*, 1944.—Sp. ht. measurements were made from 12° to 330°K., on a sample of GR-S (Buna S) by an adiabatic vacuum-type calorimeter. A Debye sp. ht. function was used to calculate values below 15°K. At about − 61°C. the material undergoes a transition of the second order, the sp. ht. increasing rapidly by 40%. From − 50° to + 60°C., the sp. ht. values can be calculated to within 0·1% by the equation $C_p = 0{\cdot}4346 + 7{\cdot}029 \times 10^{-4}t + 1{\cdot}156 \times 10^{-6}t^2$ in cal. g.$^{-1}$ deg. K.$^{-1}$. At 25°C. the sp. ht. is 1·894 internat. joules g.$^{-1}$ deg. K.. The increase in entropy from 0° to 298·16°K. is 1·824 internat. joules g.$^{-1}$ deg. K.$^{-1}$. Values of sp. ht. and increases of entropy, enthalpy and free energy, are tabulated at 5 deg. intervals. Values below the transition are dependent upon the thermal history of the sample. This can be explained on the theory that the transition results from an increasingly slow approach to the equilibrium state at temperatures in the transition region and below.

536.621 : 536.532 *see Abstr.* 218

536.631 : 548.0 *see Abstr.* 384

536.631 : 621.317.39 222

Determination of the specific heat of electrical conductors up to their melting point by an oscillographic method, with results for copper. BAXTER, H. W. *Rep. Brit. Elect. Allied Industr. Res. Ass., Ref.* G/T 170, 6 *pp.*, 1944.—[Abstr. 104 B (1945)].

536.653 : 536.66 *see Abstr.* 224, 225, 226

536.655 : 532.614 = 3 *see Abstr.* 130

536.655 : 532.62 : 541.183.53 *see Abstr.* 368

536.655 : 536.75 : 536.423.15 *see Abstr.* 214

536.658 : 541.182.04 = 3 223

On the heat of adsorption of heat-coagulated ferri-(III)-hydroxide sol. DOBROWSKY, A. *Kolloid Z.*, 106, *pp.* 46–50, *Jan.*, 1944.—The true heat of coagulation and the heat of adsorption was determined when a gel is formed by adding K oxalate to a Fe_2O_3 sol. The total heat of coagulation is the sum of the heat of adsorption and the true heat of coagulation, the latter being defined as the heat effect connected with the transition from sol to gel without the action of another substance. The precision calorimeter is described.

R. N.

536.658 : 541.183.1 *see Abstr.* 366

536.66 : 536.653 224

Heats of formation of solid and liquid $Mn(NO_3)_2 . 6H_2O$. SHOMATE, C. H., AND YOUNG, F. E. *J. Amer. Chem. Soc.*, 66, *pp.* 771–773, *May*, 1944.—By measuring the heats of solution in 1*N* H_2SO_4 at room temp., the heats of formation of $Mn(NO_3)_2$, $6H_2O$ were determined as: liquid, (− 557 070 ± 310) g. cal./mol.; solid, (− 566 680 ± 310) g. cal./mol. The heat of fusion is (9·610 ± 10) g. cal./mol. W. R. A.

536.66 : 536.653 225

Heats of formation of $Mg(NO_3)_2$, $Mg(NO_3)_2 . 6H_2O$, $Ca(NO_3)_2$, $Ca(NO_3)_2 . 4H_2O$, and $Ba(NO_3)_2$. YOUNG, F. E. *J. Amer. Chem. Soc.*, 66, *pp.* 773–777, *May*, 1944.—From measurements of heats of solution in 1·000 *N* HCl, the heats of formation, in g. cal./mol., at 25° were determined: $Mg(NO_3)_2$, − 188 770 ± 310; $Mg(NO_3)_2 . 6H_2O$, − 624 410 ± 310; $Ca(NO_3)_2$, − 224 050 ± 360; $Ca(NO_3)_2 . 4H_2O$, − 509 420 ± 370; $Ba(NO_3)_2$, − 236 990 ± 380. W. R. A.

536.66 : 536.653 226

The heats of formation of $Al(NO_3)_3 . 6H_2O$ and $Al(NO_3)_3 . 9H_2O$. YOUNG, F. E. *J. Amer. Chem. Soc.*, 66, *pp.* 777–779, *May*, 1944.—From measurement of the heats of solution of the nitrates and of Al in 4·000 *N* HCl, the heats of formation, in g. cal./mol., at 25° are: $Al(NO_3)_3 . 6H_2O$, − 680 890 ± 460 and $Al(NO_3)_3 . 9H_2O$ − 897 590 ± 470. W. R. A.

536.666 : 535.343.4 : 541.124.7 *see Abstr.* 344

536.7 : 533.7 : 531.19 *see Abstr.* 100

536.7 : 541.6 227

Phase transitions of solid paraffins and the flexibility of hydrocarbon chains. FRÖHLICH, H. *Trans. Faraday Soc.*, 40, *pp.* 498–502, *Nov.*, 1944.—At low temperatures the molecules of a paraffin crystal form plane zig-zags with a fixed angle between the chain planes and the crystal axes. According to previous suggestions, each molecule has a second equilibrium position with higher energy which is obtained by turning it 180° round its chain axis. This leads to a transition point of the second kind (λ-point) which so far has been observed in one paraffin. To account for the entropy change of this transition it is necessary to allow for a flexibility of paraffin chains leading to a twisting of chains. At the transition point, only about $^1/_2$ the chains are untwisted.

536.7 : 541.636 *see Abstr.* 373

536.75 228

The concept of entropy. DARROW, K. K. *Amer. J. Phys.*, 12, *pp.* 183–196, *Aug.*, 1944.—[See Abstr. 1113 (1943)].

536.75 : 536.6 *see Abstr.* 220

536.75 : 536.655 : 536.423.15 *see Abstr.* 214

536.77 : 541.123.2 229

On the thermodynamics of azeotropic solutions. I. Shift of equilibrium in binary systems. REDLICH, O., AND SCHUTZ, P. W. *J. Amer. Chem. Soc.*, 66, *pp.* 1007–1011, *June*, 1944.—Since the azeotropic equilibrium of a solution of two miscible liquids is characterized by temp. pressure and composition, the shift in equilibrium is exhaustively described by 2 relations between these variables. Assuming that the vapour is a perfect gas mixture, the following expressions are derived:

$$d\frac{1}{T}/dN_2 = \frac{R}{\Delta H_2 - \Delta H_1 - v\Delta H} \cdot \frac{1}{N_1}\left(\partial \ln \frac{a_2}{N_2}/\partial N_2\right)_{T,P}$$

$$d \ln P/dN_2 = \frac{\Delta H}{\Delta H_2 - \Delta H_1 - v\Delta H} \cdot \frac{1}{N_2}\left(\partial \ln \frac{a_2}{N_2}/\partial N_2\right)_{T,P}$$

where ΔH, ΔH_1 and ΔH_2 are heats of vaporization of one mol. of solution and of pure components, and v is the ratio of the difference of the partial mol. volumes in the liquid to the mol. vol. of a perfect gas under the same conditions. Azeotropic temp./composition curves depend on whether one or both components are normal, dissociating or associating. Dil. azeotropic solutions of a dissociating substance belong

to the min. v.p. type. Only when a dissociating component is present does the temp./composition curve increase or decrease without limit with decreasing conc. in dil. solutions. When the temp./composition curve of a max. (min.) extends to a pure component, this component is the more (less) volatile member. This rule holds for both upper and lower limits of the azeotropic temp. range. Isobaric temperature is suggested to connote the temp. at which v.p. of pure components are equal. The slope of the temp./composition curve is steep at this temp. if both components exhibit only small deviations from Trouton's rule. W. R. A.

536.77 : 678 : 532.71 *see Abstr.* 137

537.12 : 530.145.5 *see Abstr.* 89

537.211 : 538.11 *see Abstr.* 272

537.212 230

Electric field produced by revolving charges. Erikson, H. A. *Amer. J. Phys.*, 12, *pp.* 203–205, *Aug.*, 1944.—Considers a random group of charges $-Q$ revolving in concentric circular orbits about a charge $+Q$. The resulting ambient field is negative, tending to zero as the number of orbits approaches infinity. The percentage excess of negative over positive contribution to field is approx. inversely proportional to the number of orbits. G. F. F.

537.213 : 517.947.42 *see Abstr.* 65

537.213 : 576.333 : 591.181 231

The relation of bio-electric potentials to cell functioning. Bishop, G. H. *Ann. Rev. Physiol.*, 3, *pp.* 1–20, 1941.—This reviews 119 works dealing with potential as an oxidation phenomenon, as a function of colloidal structure, and as a diffusion process; the physical properties of the electrical circuit, dipoles *v.* the membrane hypothesis, and the interaction of the electrical process with the chemical environment. The course of excitation in nerve and muscle is discussed. C. J. G.

537.226 232

Theory of the dielectric properties of dipolar solids. Influence of dipolar interaction. Fröhlich, H. *Rep. Brit. Elect. Allied Industr. Res. Ass., Ref. L/T*142, 12 *pp.*, 1943.—It is assumed that the surroundings of a dipole are replaced by a macroscopically continuous medium. Satisfactory results are only obtained above a certain temperature which is derived in terms of the permittivity. Onsager's theory gives a correct zero approximation. Formulae are derived for the permittivity and loss whereby they can be compared with experiments, some of which are suggested. It is shown that the relaxation time should have a sharp value (at a given temperature) in crystals but occupy a whole band of values in amorphous solids. [See Abstr. 237, 241 (1945)]. A. M. T.

537.226 : 537.529 : 621.3.015.5 233

Correlations in dielectric phenomena for various types of applied voltages. Whitehead, S. *Rep. Brit. Elect. Allied Industr. Res. Ass., Ref. L/T*136, 16 *pp.*, 1943.—A number of elementary dielectric processes satisfy the superposition principle and a linear differential equation of which the coefficients may be functions of time. A knowledge of any one characteristic quantity over a range of time or frequency permits the determination of any other and also the reaction to any form of stress (subject to reversibility in some cases). Approx. definitions of capacitance and conductance with reference to intervals of observation are given, which are valid for and may be found by means of various types of voltage application. Consideration is given to non-linear phenomena likely to be encountered. Different forms of voltage application are discussed as means by which non-linear phenomena or abnormalities in linear phenomena may be revealed. The application to h.v. testing is indicated. A. M. T.

537.226 : 539.31 : 621.315.616 234

Electrical and elastic properties of amorphous polar polymers. Tuckett, R. F. *Trans. Faraday Soc.*, 40, *pp.* 448–462, *Oct.*, 1944.—It is shown that the internal viscosity which, according to Debye's dipole theory, is the cause of dielectric loss in polar polymers, is not related to the macroscopic viscosity. It is suggested that a connection exists between the dielectric and the highly elastic mechanical properties of these materials. A consideration of rate-processes of dipole orientation in amorphous polar polymers indicates that both elastic orientation and dipole relaxation have the same time constants. This is supported by experimental evidence, including the energies of activation of these and other molecular rate processes. The problem of orientation-time distribution is discussed. Some apparent experimental discrepancies are resolved and a physical picture outlined whereby the decrease in distribution breadth to a limiting value as the temperature is raised, is explained. A. M. T.

537.226 : 621.315.616.96 235

Dipolar properties of resins (application of Fröhlich's and Garton's theories). Savić, P., and Garton, C. G. *Rep. Brit. Elect. Allied Industr. Res. Ass., Ref. L/T*135, 8 *pp.*, 1943.—A mathematical examination of the combination of the conceptions of Fröhlich [see Abstr. 237, 241 (1945)] on the mechanism of the di-electric properties of dipolar solids and of Garton [Abstr. 41 (1940)] on the distribution of relaxation times in dielectrics. An attempt is made to determine Fröhlich's constants and the distribution curve of relaxation times from Garton's experimental work on synthetic resin. A. M. T.

537.226 : 621.315.616.96 236

Dielectric properties of a thermoplastic *m*-cresol resin in relation to Garton's hypothesis. Rushton, E. *Rep. Brit. Elect. Allied Industr. Res. Ass., Ref. L/T*139, 9 *pp.*, 1943.—The dielectric properties of a thermoplastic *m*-cresol resin are examined in the light of Garton's modification [Abstr. 41 B (1940)] of Debye's theory. Fair agreement is obtained at temperatures above 75°C.; at lower temperatures at which the resin is not plastic, the calculated values are greater than those observed. A. M. T.

537.226.1 237

Theory of the dielectric properties of dipolar solids. Fröhlich, H. *Rep. Brit. Elect. Allied Indust. Res. Ass., Ref. L/T*124, 15 *pp.*, 1941.—A theory of permittivity applicable to organic dipolar solids is developed mathematically. Approx. solutions of the equations are given for the normal range (< 10) and include the effect of temperature. A. M. T.

537.226.2 : 532.77 238

The dielectric properties of dipolar ions in mixed solvents. Oster, G. *J. Amer. Chem. Soc.*, 66,

pp. 948–951, *June*, 1944.—A theory of the decrease in dielectric increment of dipolar ions with decrease in permittivity of the solvent mixture is developed. On the basis of electrostatic theory, dipolar ions would be expected to sort out the solvent constituent of higher permittivity, thus producing an electrostatic shield decreasing the effective d.m. and dielectric increment of the dipolar ion, the effect becoming more pronounced as the dielectric difference between the shield and the liquid in the bulk of the solutions increases. The theory is in accord with the general features of observed results. W. R. A.

537.226.2 : 541.67 239

The dielectric constants of solutions of glycine and pyridine betaine in water-dioxane mixtures. Oster, G., Price, D., Joyner, L. G., and Kirkwood, J. G. *J. Amer. Chem. Soc.*, 66, *pp.* 946–948, *June*, 1944.—Permittivities of solutions of glycine and pyridine betaine in H_2O-dioxane mixtures at 25°C. are given. The dielectric increments of both solutes show a regular decrease with decreasing permittivity of the solvent mixture, similar to that exhibited by glycine betaine and the benzbetaines. The possibility of the reversion of pyridine betaine to the unionized form is examined and calculations show that the charged groups could approach each other, and thus account for the experimental results, only if valency bonds were terribly distorted. W. R. A.

537.226.2 : 541.67 240

Formation and structure of some organic molecular compounds. III. The dielectric polarization of some solid crystalline molecular compounds. Kronberger, H., and Weiss, J. *J. Chem. Soc.*, *pp.* 464–469, *Sept.*, 1944.—The mean permittivities of a number of polynitro-molecular compounds, of quinhydrone, and of their respective components in the solid state, have been measured in the Hertzian region by an immersion method. This furnishes new evidence in favour of the ionic character of these molecular compounds which is also supported by the discussion of some of the other physical properties in the solid state.

537.226.3 241

Theory of the dielectric properties of dipolar solids: calculation of dielectric losses. Fröhlich, H. *Rep. Brit. Elect. Allied Industr. Res. Ass.*, *Ref.* L/T132, 8 *pp.*, 1942.—The theory of dielectric properties [see Abstr. 237 (1945)] is extended to the case where the external field varies with time. Equations for the permittivity and power loss are derived and are developed in forms convenient for application to quantitative experimental tests of the theory. The implications of the theory are compared with those of Debye's and are shown to be qualitatively more in accord with experimental data. A. M. T.

537.29 : 537.311.33 *see Abstr.* 246, 247

537.29 : 591.181 242

Electricity as a pathogenic agent in the central nervous system. Ostow, M. *J. Nerv. Ment. Dis.*, 99, *pp.* 270–277, *March*, 1944.—Potential gradients of the order of 0·1 V/cm. normally occur in the central nervous system. Electric field strengths in the central nervous system are of the same order of magnitude as those required to damage nervous tissue and so may be considered potentially pathogenic. C. J. G.

537.311 : 593.171 243

Electrical conductivity of cytolysed Paramecium. Iida, T. T. *Jap. J. Zool.*, 8, *pp.* 407–414, 1940. *Abstr. in J. R. Micr. Soc.*, 61, *p.* 112, *Sept.–Dec.*, 1941.—To determine the electrical conductivity, hay cultures of *Paramecium caudatum* were cytolysed; the technique is described. The conductivity of the cytolysed organisms increases automatically with the progress of time, owing to the release of ions. The temperature coeff. is of the order of usual chemical reactions. By exposure to high temperature, the conductivity is irreversibly suppressed, showing that some thermo-labile substance is involved in the process; this was found localized in the fine granules suspended in the preparation. It does not induce conductivity change, but this is produced by a second element which is thermo-resistant. C. J. G.

537.311.1 244

The electrical conductivity of metals. Supek, I. *Z. tech. Phys.*, 24, 4, *pp.* 125–144, 1943.—By analogy with the kinetic theory, this paper calculates the lengths of the free paths of the electrons, which determine the electrical conductivity. Hence, the specific conductivity is calculated for the complete temperature range and is found to agree with the Bloch theory. E. R. A.

537.311.3 : 612.79 245

Hand and foot patterns of low electrical skin resistance: their anatomical and neurological significance. Richter, C. P., Woodruff, B. G., and Eaton, B. C. *J. Neurophysiol.*, 6, *pp.* 417–424, *Nov.*, 1943.—Experiments were made to determine the shape and distribution of the areas of low skin resistance on the hands and feet under varying conditions. The dermometer used comprised a 4·5 V battery, a micro-ammeter and a variable resistor. Differences in skin resistance, not measurements, were registered. C. J. G.

537.311.33 : 537.29 246

Semi-conductors in strong electric fields. Joffe, A. V., and Joffe, A. F. *J. Phys., USSR*, 2, 4, *pp.* 283–304, 1940.—The conductivity of Cu_2O, Se, V_2O_5, MoS_2, Sb_2S_3, WO_3, Tl_2S was investigated in fields up to 10^5 V/cm., at − 180° to + 20°C. Ohm's law is obeyed in fields up to several kV/cm., beyond which there is a region of rising conductivity. The lower the temperature, the more pronounced is the relative increase in conductivity in a given field. The photoelectric conductivity is independent of the field in the case of pure substances, but increases slightly with the field if impurities are present. Various hypotheses are proposed to account for the observed effects. [See Abstr. 2130, 2569 (1938), 804 (1939)]. A. E. T.

537.311.33 : 537.29 247

Electrical conductivity of semi-conductors with an ionic lattice in strong fields. Davydov, B., and Shmushkevitch, I. *J. Phys., USSR*, 3, 4–5, *pp.* 359–377, 1940.—A theoretical investigation of the deviations from Ohm's law. The dependence of the electron mobility on the field and temperature is different for low and high temperatures. In both cases, in fields greater than 10^5 V/cm., the electron mobility increases with the field; the mean electron energy then approaches asymptotically the value of $\frac{1}{3}\varepsilon_i$, where ε_i is the ionization energy. Finally, the number of ionizations has been calculated, and the concentration

of free electrons obtained therewith has been determined. [See Abstr. 246 (1945)]. A. E. T.

537.311.33 : 621.314.634 = 3 248

The temperature dependence of the resistance of selenium rectifiers. SCHARAWSKIJ, P. W. *J. Phys., USSR*, 3, 4–5, *pp.* 379–384, 1940.—Describes experiments in the range + 65° to − 183°C. Results show that in the forward direction, the temperature dependence for Se rectifiers is appreciably smaller than for Cu_2O rectifiers. In the reverse direction, the temperature coeff. is neg. for small voltages and pos. for large voltages; within a certain range of voltage and temperature, the resistance of the Se rectifier is practically independent of temperature. The results are discussed in the light of recent theory on the nature of rectification. A. E. T.

537.311.5 : 551.579.5 *see Abstr.* 410

537.312.6 : 612.79 249

The effects of local applications of cold upon the electrical resistance of the skin. MASLOV, A. *Fiziol. Zh. SSSR*, 28, *pp.* 264–270, 1940. *Abstr. in Biol. Abstr.*, 17, *Abstr.* 820, 1943.—Application of cold H_2O (10°C.) for 10 min. to the left hand increases the resistance against a.c., also of that of the right (not cooled) hand, although less pronounced. Daily repetition gradually diminishes the response of both hands; after 2 months the reflex increase of resistance of the right hand entirely disappears. When H_2O (7°C.) is applied after a preliminary exposure to 10°, the response reappears. Daily exposure to cold (10°) gradually shortens the period of restitution of the electrical resistance to normal values, but exposure to water of 7° again increases the restitution period. It would seem that daily exposure produces an adaptation to cold. C. J. G.

537.363 : 576.8.098 250

Studies on the microcataphoresis of animal parasites. SENEKJIE, H. A., AND SCOTT, L. C. *Proc. Soc. Exp. Biol., N.Y.*, 51, *pp.* 174–175, *Oct.*, 1942.—The knowledge of the charge of the organism is important in devising methods for its destruction *in vivo* and *in vitro*. The 5 Protozoa and 6 Nematoda used in these studies are all negatively charged. Bacteria and *Entamoeba histolytica* are both negatively charged, and it is not possible to purify cultures of the latter by electrolytic methods. C. J. G.

537.39 : 532.64 : 591.111.3 251

On the influence of weak electric currents and electrically charged surfaces on blood coagulation. SCHÜTZ, F. *J. Physiol.*, 101, *pp.* 27–35, *June*, 1942.—A weak d.c. was applied to freshly drawn blood, using two electrodes 1·8 cm. apart and a neutral electrode at the same distance from either. The results obtained with different electrodes fall into 3 groups, according as delay, inhibition or acceleration of blood-clotting was observed on the two poles. The same electrodes with similar currents had no obvious coagulating effect on proteins of heparinized blood. The clotting of the blood where the current passed through is always delayed, whatever delay or acceleration of the clotting takes place on or around the different electrodes. Some results were explained by observations of the contact angles of blood on the two poles and led to experiments which showed that, on a metal surface previously used as cathode, blood clotting is accelerated, and is delayed on the same metal when previously used as anode. C. J. G.

537.39 : 591.181 252

Alteration of frequency of pacemaker nerve cells by imposed direct current. BULLOCK, T. H. *Anat. Rec.*, 84, *pp.* 468–469, *Dec.*, 1942.—The frequency of firing of nerve cells seems to depend upon the d.c. field (electrotonic, somatic or steady-state potential) imposed upon it. Direct evidence of a change in frequency during passage of a small constant current is lacking, although various effects of polarizing complex nerve centres have been described (brain-wave amplitude changes, anaesthesia, excitability changes). Polarization of the cardiac ganglion of *Limulus* results in an abrupt, maintained reversible increase in frequency of heart-beat and changes in wave form and duration of the electrocardiogram. The effect is exerted on the ganglion. If there are potential pacemaker cells orientated in all directions, and if orientation of the d.c. with resp. to the nerve cell determines frequency of discharge, any imposed current would find some cell properly orientated for acceleration. If the magnitude of the d.c. determines frequency regardless of macroscopic or axial orientation, it would not be expected that a decreased rate would be obtained by imposing current. Wave form and other changes can be interpreted in terms of altered pattern of firing of lower-order neurons, shift of pacemaker and effects of the d.c. on frequency of firing within each burst. C. J. G.

537.39 : 591.181 253

The relation between the physical properties of electric currents and their electronarcotic action. VAN HARREVELD, A., PLESSET, M. S., AND WIERSMA, C. A. G. *Amer. J. Physiol.*, 137, *pp.* 39–46, *Aug.*, 1942.—The effects of pulse currents of various pulse durations and frequencies, a.c. of various frequencies, and d.c., are compared. An attempt is made to determine which of the several possible effects of electric current on the central nervous system is the cause of electronarcoses. Methods and apparatus are described. C. J. G.

537.525.2 = 3 254

On the theory of cathode sputtering. SEELIGER, R. *Z. Phys.*, 119, 7–8, *pp.* 482–492, 1942.—Deals with the motion of the primary atoms sputtered from a glow-discharge cathode, and discusses the experimental methods used. H. G. S.

537.525.2 = 3 255

Cathodic sputtering with oblique impact of the ions. FETZ, H. *Z. Phys.*, 119, 9–10, *pp.* 590–601, 1942.—The sputtering of fine Mo wires, even with large mean free paths in the gas, increases strongly with decreasing wire thickness. The essential cause is the obliquity of impact of the ions on the surface of the wire. The experimental verification and the method used [Abstr. 727 (1923)] are described. H. G. S.

537.525.8 256

Active nitrogen and N_2^+ (X′) ions. MITRA, S. K. *Nature, Lond.*, 154, *pp.* 212–213, *Aug.* 12, 1944.—[See Abstr. 2121 (1942)].

537.525.8 257

Variations in the after-glow brightness of active nitrogen under varied experimental conditions. MITRA,

S. K. *Nature, Lond.*, 154, *pp.* 576–577, *Nov.* 4, 1944. —(See Abstr. 2826 (1943) and 256 (1945)].

537.529 : 621.3.015.5 : 537.226 *see Abstr.* 233

537.531 : 535.338 258

Structure in the short-wavelength limit of the continuous X-ray spectrum. OHLIN, P. *Ark. Mat. Astr. Fys.*, 29*A*, 1, *No.* 3, 10 *pp.*, 1943.—The structure was investigated by the method of isochromats, i.e. for a given wavelength, the lowest voltage at which radiation of this wavelength occurs was determined. A spectrometer with curved crystal and a Geiger counter specially sensitive to soft X-rays were used. The isochromats were recorded with two kinds of crystals, calcite and topaz, and for anticathodes and cathodes of various materials [Abstr. 89 (1945)]. The wavelengths were those of Ti$K\alpha_1$ and Cr$K\alpha_1$ which correspond to threshold voltages of 4 510 V and 5 410 V respectively. The results are that the structure is independent of the wavelength within the wavelength region investigated, 2 285–3 352 X.U., and different anticathodes give rise to isochromats which are roughly the same in shape. To investigate the fine structure more closely, more sensitive methods of measurement are necessary. L. S. G.

537.531 : 535.34 259

Air absorption corrections for soft X-rays. EDDY, C. E., AND FARRANT, J. L. *Brit. J. Radiol.*, 18, *pp.* 278–279, *Sept.*, 1944.—Various methods of measurement are discussed, and the use of a cylinder, within which the air pressure can be varied, is recommended. Details of apparatus, with curves relating the correction necessary (for various voltages of tube excitation) with the half-layer value, are illustrated for beams varying in half-layer value from 0·5 to 6·0 mm. Al. B. J. L.

[537.531.9 + 539.164.94 + 539.166.94] : 576.8.095.14 260

The inactivation of plant viruses by radiations. II. The relation between inactivation dose and size of virus. LEA, D. E., AND SMITH, K. M. *Parasitology*, 34, *pp.* 227–237, *July*, 1942.—Experiments are described on the inactivation by γ-rays, X-rays and α-rays on 5 plant viruses. The inactivation curves appear to be exponential and the inactivation doses increase in the order γ-rays, X-rays (1·5 Å and 8·3 Å), and α-rays. A theory is given, explaining these results and correlating the inactivation dose with the virus size. Estimates of the sizes of the viruses obtained from the radiation expts. lie within the range of the sizes given by other methods, but are somewhat lower than the most probable sizes. Possible explanations of the discrepancy, which are discussed, are (*a*) the virus particle is not the molecule, in the sense of the smallest infective unit, or (*b*) certain structural changes in the virus molecule produced by the radiation may still leave it infective. Some of these may be mutations. C. J. G.

537.531.9 : 576.33 261

X-ray sensitivity changes in meiotic chromosomes and the nucleic acid cycle. SPARROW, A. H. *Proc. Nat. Acad. Sci., Wash.*, 30, *pp.* 147–154, *July*, 1944.—Using the number of chromosome aberrations as a measure of sensitivity it was found that sensitivity is low in early meiotic prophase. Pachytene is twice as sensitive, metaphase 6 and anaphase 9 times as sensitive as early meiotic prophase. The sensitivity of post-meiotic resting nuclei is approx. that of early meiotic prophase. Radio-sensitivity can be correlated with nucleic acid metabolism. Non-random breaks in heterochromatic regions may be associated with a difference in the amount of desoxyribose nucleic acid in such regions as compared with the adjoining euchromatic chromatin. The relationship of tumour radiosensitivity to nucleic acid content is discussed.

537.531.9 : 581.03 262

The effect of ionizing radiations on the broad bean root. VI. GRAY, L. H., AND READ, J. *Brit. J. Radiol.*, 17, *pp.* 271–273, *Sept.*, 1944.—[See Abstr. 1693 (1943)]. Bean roots were exposed in succession to 2 ionizing radiations, either to γ-rays and neutrons or to X-rays and α-particles. In the case of the latter pair of radiations, slightly more than $^1/_2$ a mean lethal dose of each radiation had to be given in order to kill $^1/_2$ the roots, independently of the order in which the irradiations were given. The primary cellular injury responsible for the death of the root is the same whichever of the 4 radiations is used, so that the large differences between the mean lethal dose for X-rays and γ-rays on the one hand, and neutrons and α-particles on the other, must be ascribed to a difference in the efficiency of these radiations in bringing about the primary injury.

537.533.72 263

The computation of electron trajectories in axially symmetric fields. GODDARD, L. S. *Proc. Phys. Soc., Lond.*, 56, *pp.* 372–378, *Nov.*, 1944.—Existing methods for calculating electron paths are discussed and some factors limiting their accuracy and general application are pointed out. A new method, which overcomes these difficulties, is proposed. The equations of motion are integrated numerically in a most direct manner, and at each stage the accuracy may be checked by using the energy equation. The method may be used in a combined electric and magnetic field, and it is not limited to paraxial rays or to rays which are initially parallel to the axis. The necessary computations may be carried out rapidly with the aid of a computing machine.

537.533.72 264

Electron-ray tracing through magnetic lenses. GODDARD, L. S., AND KLEMPERER, O. *Proc. Phys. Soc., Lond.*, 56, *pp.* 378–396, *Nov.*, 1944.—A new numerical method is presented for computing electron paths through magnetic lenses. The process is direct and accurate and is not confined to paraxial rays, nor necessarily to rays that are initially non-skew. There is direct control over the error, since the energy equation may be checked at any stage. The method agrees well with experiment and has been used to determine the spherical aberration curve.

537.533.72 : 539.163 : 621.385.833 265

Theory, design, and applications of a short-magnetic-lens electron spectrometer. DEUTSCH, M., ELLIOTT, L. G., AND EVANS, R. D. *Rev. Sci. Instrum.*, 15, *pp.* 178–195, *July*, 1944.—The lens is wound of 300 lb. of Cu wire and does not utilize iron. Its focal length for transmitted electrons can be varied from 25 to 50 cm. and the magnification from 0·5 to 2. Circular sources varying in dia. from 0·4 to 1·6 cm.

are used and the solid angle subtended at the source is varied between 0·025 and 0·1 steradian. The half-max. width of the transmitted distribution is 0·017 to 0·06 of the momentum of the focused electrons. The spectrometer was applied to studies of radioactive disintegration. Appropriate techniques are described for the measurement of discrete and continuous β-ray spectra, of coincidences of focused electrons with other radiations, and of γ-ray energies through secondary electron spectra. A special baffle system allows the separation of negatrons and positrons.

537.533.74 266

The penetration of high-energy electrons through foils. CHAO, K. T. *Sci. Rec., Acad. Sinica*, 1, 1–2, *pp.* 129–131, *Aug.*, 1942.—Electrons with various incident energies up to 7 eMV penetrate foils of C (thickness $= t = 0{\cdot}5$ cm.), Al ($t = 0{\cdot}0355$ cm.), mica ($t = 0{\cdot}05$ cm.), Pt ($t = 0{\cdot}0004$ cm.), Pb ($t = 0{\cdot}0038$ cm., 0·006 cm. and 0·05 cm., respectively) and the transmitted intensities for the electron energies are measured by an experimental method [Abstr. 2629 (1939)] and calculated theoretically [Abstr. 2597 (1938)]. The results are compared and it is found that in the case of Pb, Pt and mica, the experimental data are in good agreement with the theory, while in the case of C and Al the experimental values are lower than the theoretical. L. S. G.

537.568 : 537.581 267

The electron affinity of bromine and a study of its decomposition on hot tungsten. DOTY, P. M., AND MAYER, J. E. *J. Chem. Phys.*, 12, *pp.* 323–328, *Aug.*, 1944.—The electron affinity of Br was measured by determining the ratio of ions to electrons leaving a hot tungsten surface in contact with Br gas at low pressure. The value obtained is (80·5 ± 0·4) kcal./mole. The measurements, which extend over a range of 700 deg. in temperature and 80-fold in pressure, show no trend in the electron affinity and demonstrate that the decomposition of Br under these conditions is a first-order reaction. The assumption of unit accommodation coeff. is shown to be correct. [See Abstr. 929 (1935), 1130 (1943)].

537.581 : 537.568 *see Abstr.* 267

537.591.15 268

Cloud-chamber photographs of penetrating showers. ROCHESTER, G. D. *Nature, Lond.*, 154, *p.* 399, *Sept.* 23, 1944.

537.591.2 : 551.594 269

The energy spectrum of electrons in the atmosphere arising from the disintegration of mesotrons. STANTON, H. E. *Phys. Rev.*, 66, *pp.* 48–56, *Aug.* 1 *and* 15, 1944.—The energy spectrum of electrons at the altitude of 14 618 ft. originating from the decay of mesotrons is calculated by means of the cascade theory of showers. It is assumed that the mesotron decays into a neutrino and an electron, which are emitted with equal probability in all directions in the reference frame of the mesotron. The diffusion equations for the showers are derived with the boundary conditions that there are no incoming electrons or photons. By approximations similar to those used in the shower theory, it is possible to calculate the electron spectrum in the lower atmosphere, provided the mesotron spectrum is known. If we assume a mesotron spectrum in accordance with experiment, the theoretical calculations for the electron spectrum can be compared with new observations on the intensity of the soft component for energies higher than 5×10^7 eV. The calculations agree with experimental results (Hall and Hazen).

537.591.3 270

Banded meson spectrum and the Rossi second maximum. SARABHAI, V. *Nature, Lond.*, 154, *p.* 365, *Sept.* 16, 1944.

537.591.5 271

Production of single mesotrons by non-ionizing radiation at altitudes of 10 600 ft. and 14 200 ft. TABIN, J. *Phys. Rev.*, 66, *pp.* 86–91, *Aug.* 1 *and* 15, 1944.—The production of single mesotrons in various materials was studied by means of an apparatus consisting of 46 G-M counters arranged in 10 different 3-, 4- and 5-fold coincidence sets. The producing layers consisted of different thicknesses of paraffin, iron and lead. The results indicate that photons are the most probable agent for the production of the single mesotrons. The cross-section for the mesotron production is calculated for the various producing materials.

537.591.8 : 517.948.34 *see Abstr.* 67

538.11 : 537.211 272

Coulomb's law and the dielectric constant. MURDOCK, C. C. *Amer. J. Phys.*, 12, *pp.* 201–203, *Aug.*, 1944.—In 1933 Wilberforce [Abstr. 1639 (1933)] drew attention to the fact that the insertion of μ into the denominator of the equation for Coulomb's law of magnetostatics was wrong. Following 1935, examination of 38 textbooks dealing with magnetostatics discloses that 21 repeat the error, especially those most recently issued. Wilberforce's conclusions are justified and it is suggested that the attention of physics teachers should be drawn to the matter. G. F. F.

538.11 : 621.318 273

Magnetism in theory and practice. STONER, E. C. *J. Instn Elect. Engrs*, 91, *Part I, pp.* 340–349, *Sept.*, 1944.—Kelvin Lecture. [Abstr. 116 B (1945)].

538.114 : 621.3.013 274

The magnetization of polycrystalline iron and iron-silicon alloys. RICHER, G. C. *J. Iron Steel Inst.*, 50 *pp., Sept.*, 1944. *Advance copy.*—[Abstr. 27 B (1945)].

538.2 : 669.14 275

Relationship between coercive force and carbon content of plain carbon steels. TAI, L. C. *Nature, Lond.*, 154, *p.* 338, *Sept.* 9, 1944.

538.214 : 541.128.3 276

Magnetic studies of chromium oxide catalysts. TURKEVICH, J. *J. Chem. Phys.*, 12, *pp.* 345–346, *Aug.*, 1944.—The susceptibility of active Cr_2O_3 gel and glowed inactive Cr_2O_3 was measured from liquid-air temp. to 444°C. and no difference in magnetic behaviour was noted. Activated adsorption of H does not affect the susceptibility of the active gel catalyst. The interaction of chromic nitrate with NH_3, filtration and drying, results in a chromium oxide intermediate in oxygen content to Cr_2O_3 and CrO_3. Revivification of the catalyst by oxygen treatment results in a similar chromium oxide.

538.214 : 552.64 277

The magnetic behaviour of a tektite. SIGAMONY, A. *Proc. Indian Acad. Sci. A*, 20, *pp.* 15–17, *July*, 1944.—A sample of tektite from the island of Billiton had sp. gr. 2·448, susceptibility $7{\cdot}78 \times 10^{-6}$ per g. at 25°C. and was magnetically isotropic. From the susceptibility, the estimated FeO content is 5·8% in agreement with the known structure and composition of tektites. W. R. A.

538.67 278

Test for change of pole strength of permanent magnet. GOLDMAN, J. E. *Phys. Rev.*, 66, *p.* 94, *Aug.* 1 *and* 15, 1944.—The author has carried out experimental tests. details of which are given, of Ehrenhaft's report of an approximately 10% loss of strength of a permanent magnet when acidulated water is placed between the poles of the magnet in contact with the pole faces and allowed to remain so for a period of time. The accuracy of the repeat experiments was within 1%, and two sets were carried out with 4% and 12% sulphuric acid respectively, wherein the magnet poles were exposed to the magnetolytic action of the acid for 18 and 60 hr. respectively. In both cases the field of the magnet was found to be identical with the values obtained at the beginning of the experiments. H. H. HO.

538.67 279

Effect of iron tube on its magnetizing field. LIN, S. T. *Phys. Rev.*, 66, *pp.* 57–65, *Aug.* 1 *and* 15, 1944.—When an iron tube is magnetized along its length in a uniform field, the intensities inside as well as outside the tube are reduced by amounts which depend upon the intensity of magnetization. This is also true for the field outside an iron rod. From the distribution of the intensities of magnetization along the tube, which are experimentally determined, the amounts of reduction of the magnetic fields may be calculated by applying Würschmidt's theory of the demagnetizing factor. The theoretical values agree with experiments.

538.69 280

Magnetic ions. HOPPER, V. D. *Phys. Rev.*, 66, *pp.* 93–94, *Aug.* 1 *and* 15, 1944.—Ehrenhaft's claim to have established the existence of magnetic ions [*ibid.* 57, p. 659, 1940] is put to experimental test by a modification of the apparatus [Abstr. 2168 (1941)] in the determination of the electronic charge, a horizontal magnetic field being substituted for the electric field. Thousands of nickel particles have been observed, many being in the field of view at the one time, but no particle has been detected moving in such a manner as to verify the magnetic ion hypothesis. In the centre of the magnetic field all particles fell vertically, and on either side of the central line particles either remained undeflected or deflected towards the nearer pole; no particles crossed the centre of the field. The experiments were repeated with iron and rouge particles but with the same negative results. The possible explanation of Ehrenhaft's results is that the particles he observed were electrically charged and were acted on by some stray electric field such as that produced between the coils of the electromagnet. H. H. HO.

538.69 281

The magnetic current. EHRENHAFT, F. *Nature, Lond.*, 154, *pp.* 426–427, *Sept.* 30, 1944.—Vertical magnetic and electric fields are described which permit measurements of forces on particles down to 8×10^{-11} dynes by comparing them with the gravitational force exerted upon the single particle. The essential facts proving the existence of the magnetic current are stated to be the following: (1) Polar movement of single particles to the north or to the south in a homogeneous magnetic field in gases, reversing their direction with the reversal of the field, their velocity depending on the field strength. (2) The observation of magnetophotophoresis. (3) The magnetolysis of water, which proves that magnetism is polar. (4) The loss of pole strength by the permanent magnets during the magnetolytic processes, which is the counterpart of the loss in pole-strength of Volta's pile during electrolysis. (5) The observation of an electric vortex around the iron wire connecting the two poles of an electromagnet or a permanent magnet in a surrounding liquid bearing electrostatic charges; this is the counterpart to the magnetic vortex around the wire connecting the two poles of Volta's pile. (6) Particles can carry simultaneously electric and magnetic charges. (7) A polar movement in the geomagnetic field alone simultaneously with the north and south movements of microscopic particles of nickel or iron in gases at atmospheric pressure, when they are irradiated by light. The author also claims that there is no doubt about the validity of measurements of smaller charges than the electronic charge. H. H. HO.

538.69 282

Gases evolved by magnetized iron in sulphuric acid. HOFF, R. L., NAUGHTON, J. J., SMOLUCHOWSKI, R., AND UHLIG, H. H. *Phys. Rev.*, 66, *p.* 92, *Aug.* 1 *and* 15, 1944.

539.13 283

Dextran and levan molecules studied with the electron microscope. INGELMAN, B., AND SIEGBAHN, K. *Nature, Lond.*, 154, *pp.* 237, *Aug.* 19, 1944.

539.133 284

The dipole moment and structure of trioxane. MARYOTT, A. A., AND ACREE, S. F. *J. Res. Nat. Bur. Stand., Wash.*, 33, *pp.* 70–74, *July*, 1944.—Trioxane is a solid polymer of formaldehyde resembling dioxane in its chemical properties. The molecule can possibly exist in two spacially different forms resembling a chair and a cradle, for which the theoretical dipole moments are 2·3 and $0{\cdot}6 \times 10^{-18}$ respectively. The experimental value in benzene was found to be $2{\cdot}18 \times 10^{-18}$ esu. It is concluded that ordinary trioxane is largely in the chair form, possibly in equilibrium with a small amount of the cradle form. This cyclic ether would therefore be suitable for mixing with non-polar solvents to study the effect of increased polarity on the activities and absorption spectra of indicators.

539.133 : 532.133 : 541.68 = 3 *see Abstr.* 375

539.133 : 541.57 *see Abstr.* 372

539.152.1 285

Vector-pseudovector meson theory. ERIKSSON, H. A. S. *Ark. Mat. Astr. Fys.*, 29*A*, 2, *No.* 10, 11 *pp.* 1943.—Some properties of the 16 components of an undor are noted and the field equations are written

a spinor and tensor form. These apply to all 4 types of fields, vector-, scalar-, pseudovector- and pseudoscalar meson fields. A restriction is then made to the case where the undor is symmetric in its non-mixed components (this may be regarded as a limiting case) and a vector-pseudovector theory is obtained in this way. The theory is applied to the static interaction between nuclear particles and it is shown that the dipole term in this interaction may be removed in a more natural way in the vector-pseudovector theory than in the vector-pseudoscalar theory.

L. S. G.

539.152.1 286

The divergence difficulty of quantized field theories. TENG, H. W. *Nature, Lond.*, 154, *pp.* 544–545, *Oct.* 28, 1944.—[See Abstr. 1017 (1944)].

539.152.1 : 530.145.63 *see Abstr.* 93

539.152.1 : 539.165.2 *see Abstr.* 295

539.155.2 287

The radioactivity of potassium from human sources. KENN, W. O., BALE, W. F., AND MULLINS, L. J. *J. Gen. Physiol.*, 25, *pp.* 345–353, *Jan.*, 1942.—Data accumulated over several years and here recorded and discussed indicates that the radioactive isotope K^{40} is probably 1 or 2% less abundant in human K than in that from commercial sources. C. J. G.

539.155.2 : 539.172.4 288

On neutron-induced activities in aluminium. EKLUND, S., AND HOLE, N. *Ark. Mat. Astr. Fys.*, 29*A*, *No.* 26, 16 *pp.*, 1943.—The half-lives and energy spectra of ^{28}Al and ^{27}Mg are studied by means of the following reactions, caused by the irradiation of Al with neutrons: $^{27}_{13}Al + ^{1}_{0}n = ^{28}_{13}Al + \gamma$, $^{27}_{13}Al + ^{1}_{0}n = ^{27}_{12}Mg + ^{1}_{1}p$, $^{27}_{13}Al + ^{1}_{0}n = ^{24}_{11}Na + ^{4}_{2}\alpha$. The neutrons were produced by irradiating metallic Be with 50 μA deuterons of an energy approx. 6 eMV. The method and apparatus for making the measurements are fully described. The β-spectra were studied by means of a cloud chamber filled with air at 1·30 kg./cm.^{2} and a mixture of equal parts of ethyl alcohol and H_2O. The magnetic field for deflection was produced by a pair of Helmholtz coils, and had an average value of 530 gauss. The γ-spectra were also studied and the results are:

	^{28}Al	^{27}Mg
Half-life min.	2·30 ± 0·03	9·58 ± 0·10
$E\beta$ max. eMV	2·98 ± 0·18	1·77 ± 0·09
$E\gamma$. eMV	2·05 ± 0·15	1·05 ± 0·08

From the measurements, no indication is found that the β- or γ-spectra are complex. Assuming a single line, the masses of ^{28}Al and ^{27}Mg were calculated. With $^{28}Si = 27·98723$ the value for ^{28}Al is 27·99263 and with $^{27}Al = 26·99069$; the value for ^{27}Mg is 26·99372. L. S. G.

539.16.08 289

A scale-of-N counter and the sensitiveness towards light of a Geiger–Müller tube. BERGSTRAND, E. *Ark. Mat. Astr. Fys.*, 29*A*, 4, *No.* 31, 7 *pp.*, 1943.—A description is given of the circuit and mode of operation of a simple valve scale for recording impulses from a G–M tube. Only 5 valves are used. Valves I and II are 6C6g pentodes which amplify the pulses, Valve III is a 6J5g and Valve IV a 6G6g rectifier, while Valve V is an 885 thyratron. Experiments regarding the sensitivity (s) of the G–M tube towards light are described and s increases by working the tube at h.f. At 2×10^5 impulses/min. a max. was reached after 10 min. Adsorption of the gases present on the cathode surface seem to account for the phenomenon. [See Abstr. 1111 (1939)]. L. S. G.

539.16.08 290

Reduction of the natural insensitive time in G–M counters. SIMPSON, J. A., JR. *Phys. Rev.*, 66, *pp.* 39–47, *Aug.* 1 *and* 15, 1944.—The limitation on the G–M counter insensitive time which is imposed by the presence of the pos. ion space charge is reduced by collecting the pos. ions on the counter centre wire instead of at the outer cylinder. The electronic circuit which carries out this process is described in detail. A reduction by another order of magnitude in the insensitive time or an insensitive time of about 2×10^{-5} sec. is obtained with no indication that the limit of the new method has been reached. The general properties of an inverse counter are discussed. The mechanism of this mode of counter operation is explained with considerable evidence indicating the presence of 3 distinct ion-collection regions for the neg. centre wire. A stable circuit useful as a research tool has been devised for use with a large variety of counters.

539.16.08 = 690 291

On the use of a multivibrator as a Geiger–Müller counter external quenching circuit. CHAGAS, C., GONÇALVES, J. M., AND MACHADO, A. L. *Rev. Brasil. Biol.*, 4, *pp.* 123–124, *April*, 1944.—In experiments with radio-isotopes, a special feature was the use of a multivibrator external quenching circuit which is illustrated. The power supply used was a pentode neon-lamp-stabilized unit and the counter was connected to the h.t. terminal through a dry battery set. At the beginning of any measurement, the starting point of the counting was adjusted by means of the power unit's potentiometer, and a const. voltage rise in accordance with the plateau graph was added. C. J. G.

539.16.08 : 531.72 : 533.15 = 3 292

Determination of surface and measurement of diffusion by radioactive rare gases. III. The process of producing emanation from disperse systems. Conclusions regarding the evaluation of measurements of emanation power and the interpretation of results. ZIMENS, K. E. *Z. phys. Chem.*, 192, *pp.* 1–55, *July*, 1943.—[See Abstr. 1991 (1943)]. The difficulties encountered when applying the method developed for the case of a single grain to the case of disperse systems are discussed. In order to explain discrepancies between results obtained with 2 different kinds of emanation, the recoil is separated into a direct and an indirect component. The temperature behaviour of the emanation power is discussed under consideration of this new conception. The results of the determination of surface according to the present method are surveyed and compared with those of other methods. The diffusion component of emanation power, and its temperature dependence, is discussed and remarks are made on the measurement of gas permeability and gas diffusion through

pores, with radioactive rare gases. Some emanation-power/temperature curves are given for the reaction $Fe_2O_3 \rightleftarrows Fe_3O_4$ under different oxygen pressures. These curves are a good example of the "point effect" which manifests itself by a pointed max. in these curves. R. N.

539.16.08 : 531.72 : 533.15 = 3 293

A remark on the article by K. E. Zimens: Determination of surface and measurement of diffusion by radioactive rare gases. JAGITSCH, R. *Z. phys. Chem.*, 192, *pp.* 56–59, *July*, 1943.—Some critical remarks are made concerning the evaluation of the emanation-power/temperature curves [Abstr. 1991 (1943), 292 (1945)] in connection with their theoretical foundation [Abstr. 1445 (1939)]. The mechanism of the migration of emanation is not sufficiently elucidated to allow of a quantitative application of the method. R. N.

539.163 : 621.385.833 : 537.533.72 *see Abstr.* 265

[539.164.94 + 539.166.94 + 537.531.9] : 576.8.095.14 *see Abstr.* 260

539.165.2 294

Analysis of beta-disintegration data. I. The Sargent curves and Fermi and K.U. theories of beta-radioactivity. WANG, C. S., AND CHANG, W. Y. *Sci. Rec., Acad. Sinica*, 1, 1–2, *pp.* 98–103, *Aug.*, 1942.—The Sargent curves are plotted for a number of β-emitters, and it is found that the radioactive elements group themselves more closely into Sargent curves when the positive and negative emitters are plotted separately. A comparison is made with the Fermi theory and the Konopinski and Uhlenbeck theory [Abstr. 3410 (1935), 929 (1944)] of β-decay, calculations being made of $|M|^2/\tau_0$ for each element, where M is the matrix element of the heavy particle and τ_0 is the universal decay time. The values of $|M|^2/\tau_0$ fall into groups of different orders of magnitude, namely 10^{-24}, 10^{-26} and 10^{-28} or 10^{-25}, 10^{-27} and 10^{-29}, according to whether Fermi's or K.U.'s form of interaction is taken. The classification of $|M|^2/\tau_0$ is satisfactory and there is good agreement between theory and experiment. L. S. G.

539.165.2 : 539.152.1 295

Analysis of beta-disintegration data. II. The probability of beta-disintegration and the complexity of the atomic nuclei. CHANG, W. Y., AND WANG, C. S. *Sci. Rec., Acad. Sinica*, 1, 1–2, *pp.* 103–108, *Aug.*, 1942.—The values of τ_0 and $|M|^2$ [see Abstr. 294 (1945)] for He^6 are calculated, the latter being compared with that of Grönblom [Abstr. 4279 (1939)]. The difference in $|M|^2$ between positive and negative emitters is discussed and interpreted and the variation of $|M|^2$ with Z, the atomic number, is explained as due to the greater rearrangement of the nuclear constituents after a β-transition as Z becomes larger. The effect of isotope number and of a nuclear Coulomb field in the theory of beta-disintegration is studied and it is verified that the decay constants of positive emitters decreases with isotope number while that of negative emitters increases with the isotope number. The selection rules for different beta-transformations [Abstr. 3585 (1936)] are also studied. L. S. G.

[539.166.94 + 539.164.94 + 537.531.9] : 576.8.095.14 *see Abstr.* 260

539.172 : 541.141 296

Radiochemistry of aqueous solutions. WEISS, J. *Nature, Lond.*, 153, *pp.* 748–750, *June* 17, 1944.—Allsopp's conclusions [see Abstr. 1159 (1944)], that in gaseous systems there is a great similarity between radiochemical and photochemical processes and that their mechanisms are essentially the same, are extended to solutions, and it is shown that all the known facts on the radiochemistry of aq. solutions (important biologically) can be interpreted on the basis of known photochemical or chemical reactions in solution. Radiochemical changes are discussed for H_2O, H_2O_2, I or Br ions, ferrous salts, and ceric salts. Some quantitative relations are derived from the mechanisms proposed. N. M. B.

539.172.4 : 539.155.2 *see Abstr.* 288

539.185 : 621.384 297

A simple neutron generator using the D–D process. EKLUND, S. *Ark. Mat. Astr. Fys.*, 29*A*, *No.* 7, 12 *pp.*, 1943.—The nuclear reaction $^2_1D + ^2_1D = ^3_2He + ^1_0n + Q$, which yields strongly mono-kinetic neutrons [Abstr. 881 (1941)] is the basis of the method of generation. Details of the apparatus are given, including the positive-ion source and the accelerating tube. The method of evacuation and the precautions to be taken are discussed as well as the method for measuring the ion current. As a measure of the neutron output it is noted that at 170 kV and 300 μA, a neutron activity corresponding to 3 g. RaBe is obtained.. L. S. G.

539.185.9 : 576.8.095.14 298

The action of neutrons on bacteria. SPEAR, F. G. *Brit. J. Radiol.*, 17, *pp.* 348–351, *Nov.*, 1944.—Suspensions of *B. mesentericus* spores and of *B. coli* were exposed to gradually increased doses of neutrons and the lethal dose observed. The curve obtained by plotting the proportion of surviving bacteria as a function of dose was exponential in form. *B. coli* were more sensitive to neutron radiation than the spores of *B. mesentericus* and in this respect the results resemble those already obtained with γ-rays, but differ from them in degree. The ratio of the γ-ray dose to the neutron dose required to produce a 50% lethal effect was 3·2 for *B. coli* and 5·3 for spores of *B. mesentericus*.

539.214 : 517.946.9 *see Abstr.* 63

539.215 : 553.61 : 631.43 299

Studies of clay particles with the electron microscope. III. Hydrodynamic considerations in relation to shape of particles. KELLEY, O. J., AND SHAW, B. T. *Proc. Soil Sci. Soc. Amer.*, 7, *pp.* 58–68, 1942. *Abstr. in Exp. Sta. Rec.*, 90, *pp.* 452–453, *April*, 1944.—An equation that determines the thickness of soil particles when the settling velocity and cross-sectional area of the particles are known is presented. The electron microscope is used to determine the cross-sectional area. The dickite had a mean axial ratio of 1 : 14·8 for the 2 μ–1 μ fraction and 1 : 10 for 5 μ–2 μ. The mean axial ratio for the 2 μ–1 μ fraction of kaolin was 1 : 6·7. Quartz particles tend to be somewhat thicker than the other materials studied. The mean axial ratios were 1 : 3·5 for the 5 μ–2 μ fraction, and 1 : 3·1 for the 2 μ–1 μ fraction. Bentonite exhibited a wide range of ratios. The mean axial ratio of

the 5μ–2μ fraction was 1 : 4·4, of the 2μ–1μ fraction 1 : 7, of the 0·5μ–0·2μ fraction 1 : 40, and of the 0·2μ–0·5μ fraction 1 : 54. The ratios for the larger fractions were large, those for the smaller fractions extremely small. A mechanical analysis of quartz gives, in general, a size distribution of primary particles. The mechanical analysis of dickite came the nearest to giving a size distribution of primary particles of any of the analyses made of the clay materials studied. The larger particles of bentonite and kaolinite are, in general, aggregates of smaller primary particles. Data on halloysite indicate that the fractionation of rod-shaped particles on the basis of settling velocity is not accomplished with the same degree of accuracy as fractionation of the disc-shaped particles. There is considerable overlapping from one fraction to another. C. J. G.

539.217 : 539.4.019 : 676 300

Effect of esterification of pulp fibres upon strength properties, hygroscopicity, and hygroexpansivity of paper. HARRISON, J. J. *Paper Tr. J.*, 119, *TAPPI Sect.*, *pp.* 42–52, 1944.—The cellulose of rag and wood pulps was modified by partial acetylation, butyrylation and stearoylation, and the effects on the physical properties determined. Since both the rate of absorption of water in a humid atmosphere, and the change in dimensions of the paper made from the pulp with varying moisture content, depend on the availability of free hydroxyl groups, they are considerably reduced by such esterification, and to extents which increase with increases in the degree of substitution and with the length of the acyl chain. With the acetylated and butyrylated pulp, and with fibres, a fair proportion of the physical strength properties is retained and substantial reductions in hygroscopicity and hygroexpansivity occur when acetone or a dilute emulsion of benzene in water is used in place of water as a beating and sheet-forming medium; unsuccessful results were obtained with stearoylated fibres. J. G.

539.217.3 301

Permeability of keratin membranes. KING, G. *Nature, Lond.*, 154, *pp.* 575–576, *Nov.* 4, 1944.—At water contents below 6% on the dry weight, the diffusion const. becomes extremely small in comparison with its value at higher concentrations.

539.217.5 302

Water-vapour permeability of sheet materials at high temperature and humidity. Tentative Standard TAPPI T464 m-44. *Paper Tr. J.*, 119, *TAPPI Sect.*, *pp.* 35–38, 1944.—A modification of the ordinary gravimetric dish method, involving the use of a new type of dish, is described. The flat dish, sealed with the sample and containing $CaCl_2$ or anhydrous Mg perchlorate, is weighed and exposed to circulating air at 100° ± 1°F. and (90 ± 2)% rel. humidity, and reweighed at intervals. The gain in weight is plotted against the time, and if the slope of the resulting straight line is such that x mg. are gained in y hr., and the exposed area of paper is a cm.^{2}, then the water-vapour permeability is $240x/ay$ g./m.^{2}/24 hr. The reproducibility is 20% of the mean, or 0·2 g./m.^{2}/24 hr., whichever is the larger. J. G.

539.24 : 532.13 : 676 303

Disintegration of cellulose. STEURER, E. *Chem. Tech.*, 16, *pp.* 1–3, 1943.—Electron-microscope observation of wood pulp after milling in a Vibratom oscillating mill reveals the smallest structural units, fibrils of mean dia. 150 Å, and of a length depending on the duration of milling. The lattice structure of the X-ray diagram of cellulose disappears on milling, but treatment with water restores the cellulose hydrate modification. On milling, the viscosities of wood pulp, ramie, cotton, methyl and ethyl cellulose, cellulose acetate, polyvinyl alcohol, polyvinyl acetate and polystyrene all approach a const. value after an initial drop. J. G.

539.26 304

The measurement of X-ray wavelengths by the powder method: Cr$K\beta_1$ and Mn$K\beta_1$. LIPSON, H., AND ROGERS, E. R. *Phil. Mag.*, 35, *pp.* 544–549, *Aug.*, 1944.—An accurate value of the lattice parameter (p) of a cubic material (Si) was found in terms of the wavelengths of Cu$K\alpha$ and Co$K\alpha$ radiations and the wavelengths of Cr$K\beta_1$ and Mn$K\beta_1$ were then found in terms of p. The values obtained are (2 080·60 ± 0·01)X for Cr$K\beta_1$ and (1 906·31 ± 0·02)X for Mn$K\beta_1$, although in the last case the value depends on whether the Mn is plated on Cu or on Co. A reason for this variation is suggested. The value of p is found to be (5·41964 ± 0·00005)kX at 25°C. The powder method is described and its advantages noted. [See Abstr. 3545 (1935), 928 (1941)]. L. S. G.

539.26 305

Identification of the Montmorillonite group of minerals by X-rays. MACEWAN, D. M. C. *Nature, Lond.*, 154, *pp.* 577–578, *Nov.* 4, 1944.

539.31 306

A renaissance of mechanical properties. VIVIAN, A. C. *Proc. Instn Mech. Engrs*, 151, 2, *pp.* 105–115, 1944.—The method of calculating stresses and strains on the original cross-section and length introduces errors in the case of ductile metals, and is only of general usefulness. The true stress/strain curve lies between the nominal compressive and tensile curves, and the yield point is a peculiarity of iron, steel and some other metals in a certain condition and is not characteristic of the stress/strain curve. The true source of mechanical properties lies in specific resistance to a load, specific deformation under the load, the loading rate and the temperature. The mechanical properties of a metal can be given in terms of 3 stress properties and 3 strain properties. In the Discussion, it was considered that test data would have to include more than the author's 6 points, and it was to be regretted that the vitally important fatigue endurance test had only been briefly referred to. The clear distinction made between notch sensitivity and toughness would be useful both to students and practical engineers. The modulus of plastic flow is akin to the work-hardening capacity. Anglo-American collaboration might be opportune for deciding on standard symbols. G. E. A.

539.31 307

Poisson's ratio at high temperatures. EVERETT, F. L., AND MIKLOWITZ, J. *J. Appl. Phys.*, 15, *pp.* 592–598, *Aug.*, 1944.—A method is given for obtaining the modulus of elasticity in tension (E) and the sheer modulus (G) from a simple test on a cantilever speci-

men subjected to combined bending and twist. The Poisson's ratio (ν) at various temperatures from ambient to 1 000°F. is obtained for 5 common steels (the compositions are given) by means of the relation $\nu + 1 = E/2G$. The results are compared with those obtained by other authors. L. S. G.

539.31 : 620.171 308

The significance of tensile and other mechanical test properties of metals. O'NEILL, H. *Proc. Instn Mech. Engrs*, 151, 2, *pp.* 116–146, 1944. *Abridgm. in Engineering*, 156, *pp.* 18–20, *July* 2; 38–40, *July* 9, *and pp.* 56–58, *July* 16, 1943.—[Abstr. 5 B (1945)].

539.31 : 621.315.616 : 537.226 *see Abstr.* 234

539.319 309

The lines of principal stress in the plane problem of plasticity. AMENT, W. S. *Quart. Appl. Math.*, 1, *pp.* 278–279, *Oct.*, 1943.—A relation is established between these lines and the lines of principal curvature on certain Weingarten surfaces. L. S. G.

539.32 : 549.211 310

Elastic constants of diamond. BHAGAVANTAM, S., AND BHIMASENACHAR, J. *Nature, Lond.*, 154, *p.* 546, *Oct.* 28, 1944.

539.37 311

On the deflection of anisotropic thin plates. MORKOVIN, V. *Quart. Appl. Math.*, 1, *pp.* 116–129, *July*, 1943.—The elastic medium considered is assumed to have at each point at least 1 plane of elastic symmetry parallel to the neutral plane of the plate. The deflection satisfies a 4th-order partial differential equation, which satisfies prescribed conditions at the boundary C_0 of the neutral surface of the plate. A general method of solution is indicated when C_0 is an analytic curve, and a detailed solution is given in the case of a clamped elliptic plate with a polynomial loading function. L. S. G.

539.37 = 82 312

Application of the theory of plastic deformation to calculations of creep at high temperatures. BELAIEV, H. M. *Bull. Acad. Sci., USSR* (*Dep. Tech. Sci.*), *No.* 7, *pp.* 22–34, 1943.—A detailed mathematical treatment of elastic and plastic deformation in relation to three typical examples indicates the possibility of applying the theory of plastic deformation to calculations of creep in metal structures. E. R. A.

539.382 : 534.22 313

Young's modulus of elasticity of fibres and films by sound-velocity measurements. BALLOU, J. W., AND SILVERMAN, S. *J. Acoust. Soc. Amer.*, 16, *pp.* 113–119, *Oct.*, 1944.—A method is described and the results of an exploratory study of the modulus in various natural and synthetic fibres and films are given. The procedure involves measuring the sound velocity and calculating the modulus, using the proper density value. The modulus so calculated is characteristic of a dynamic, short-period measurement, since a sound frequency of approx. 10 kc/s was used. The range of moduli found was from 1×10^{10} to 50×10^{10} dynes/cm.^{2} Correlations of moduli with other physical properties are given.

539.385 : 532.51 : 517.945 *see Abstr.* 62

539.388.8 : 678 : 532.71 *see Abstr.* 138

539.389.4 : 536.413 *see Abstr.* 210

539.4.001.2 314

A contribution to the application of the theory of constant energy of deformation. MELDAHL, A. *Brown Boveri Rev.*, 30, *p.* 204, *July–Aug.*, 1943.—The 3 principal stresses, represented by vectors 120° apart, are added vectorially to give the "comparative stress": $\sigma_g^2 = \sigma_1^2 + \sigma_2^2 + \sigma_3^2 - \sigma_1\sigma_2 - \sigma_2\sigma_3 - \sigma_3\sigma_1$. W. W. C.

539.4.01 315

An investigation of the technical cohesive strength of metals. MCADAM, D. J., JR., AND MEBS, R. W. *Amer. Inst. Min. Metallurg. Engrs, Tech. Publ. No.* 1615, 63 *pp.*, 1943.—The technical cohesive strength (estimated resistance to fracture) cannot be represented by a single stress value but comprises an infinite number of cohesion limits, each representing a specific stress combination at fracture. Plastic extension causes a continuous increase in the technical cohesive strength. The limiting yield stress decreases with increase in the volume stress, the algebraic average of the 3 principal stresses. Tests have been made on an oxygen-free Cu, Monel metal, 13–2 Cr-Ni steel, a 0·2% C steel (S.A.E. 1020), and a 0·04% C steel, to determine the influence of combinations of principal stresses and of plastic extension on the technical cohesion limit, ultimate stress, yield stress and ductility, the investigation including the influence of notch depth, angle, and root radius, on the tensile properties. A. C. W.

539.4.01 316

The technical cohesive strength and other mechanical properties of metals at low temperatures. MCADAM, D. J., JR., AND MEBS, R. W. *Proc. Amer. Soc. Test. Mater.*, 43, *pp.* 661–706, 1943.—The paper discusses diagrams representing the technical cohesive strength of metals at room temperature and at low temperatures. Comparison of these diagrams shows the influence of low temperatures on the form of the diagram and gives a basis for interpretation of the influence of low temperature on the strength, ductility and total work of notched and unnotched specimens. A study was made of the quantitative variation of the technical cohesive strength and other mechanical properties. This variation is studied with ref. to the usual scale of temperatures, and with ref. to a scale of equal thermodynamic efficiencies.

539.4.01 : 669 317

The technical cohesive strength of some steels and light alloys at low temperatures. MCADAM, D. J., JR., MEBS, R. W., AND GEIL, G. W. *Amer. Soc. Test. Mater., Prepr. No.* 27, 29 *pp.*, 1943.—An investigation was made of a high-carbon steel, a stainless steel, duralumin and Mg alloys. Tension tests of notched and unnotched specimens were made at room temperature and at selected low temperatures down to that of liquid air. Diagrams are constructed to show the influence of notch depth, notch angle, and root radius on strength and ductility. A study is thus made of the influence of the ratio of radial to axial stress on the technical cohesion limit and the influence of plastic deformation, heat treatment and temperature, on technical cohesive strength. Diagrams are included to show the quantitative variation of strength and ductility with temperature.

539.4.011.25 : 620.172.2 318

Fracture: its energy distribution and specific energy. VIVIAN, A. C. *Engineering*, 157, *pp.* 421–424, *June* 2, 1944.—[Abstr. 6 B (1945)].

539.4.019 319

Thermal fatigue of metals. BOAS, W., AND HONEYCOMBE, R. W. K. *Nature, Lond.*, 154, *p.* 338, *Sept.* 9, 1944.—[See Abstr. 1833 (1944)]. Correspondence.

539.4.019 : 676 320

Relationship between the bursting strengths of laboratory-made and mill-made paper. COTTRALL, L. G., AND GARTSHORE, J. L. *Proc. Tech. Sect. Paper Mkrs' Assoc.*, 24, *pp.* 261–307, 1943.—The following factors result in a reduction of the bursting strength of laboratory-made sheets: A high consistency at the time of forming the sheet; the absence of a shake; inadequate disintegration of the stock before the sheets are made (although the influence of this factor is not always consistent); prevention of the sheet from shrinking by drying it on gloss plates (strength reduction about 7%); preventing it from shrinking in one direction by applying a unidirectional tension during drying; a reduction in substance when the sheet is made at high consistency (0·3%). The lower strength of paper made on a fourdrinier machine as compared with the P.M.A. laboratory apparatus is due mainly to the relative inefficiency of the wet end of the machine (24% loss), and to the unidirectional tension during drying (15% loss). Wood pulps of different classes behave differently in the above respects, but the std. P.M.A. method is satisfactory for comparisons of evaluations of beaten pulps of the same class. When critical comparisons are to be made, unidirectional tension tests and tests on sheets made at 0·2% consistency should be included. J. G.

539.4.019 : 676 : 539.217 *see Abstr.* 300

539.431 321

Conditions of failure and factors of safety in members subject to alternating stresses. SERENSEN, S. V. *Phil. Mag.*, 35, *pp.* 470–477, *July*, 1944.—Various formulae are found which facilitate calculation of the strength of machine details under the influence of alternating stresses. There is a discussion of the Smith diagram (giving the strength for simple tension and simple torsion) and expressions are found for the factor of safety in the case of simultaneous application of bending (or tension) and torsion. L. S. G.

539.431 : 669.14 322

Fatigue strength of fillet-weld and plug-weld connections in steel structural members. WILSON, W. M., BRUCKNER, W. H., DUBERG, J. E., AND BEEDE, H. C. *Bull. Univ. Ill. Engng Exp. Stn, No.* 350, 94 *pp.*, *March* 14, 1944.—A series of exploratory tests was made which did not include comprehensive investigations of the fatigue strength of fillet-weld and plug-weld joints. Of the various types of fillet-weld joints connecting plates which were tested, none had a significantly greater fatigue strength than the simple joint with longitudinal fillet welds along the sides and transverse fillet welds across the ends of the plates. In the case of fillet-weld joints connecting channels to plates, that having longitudinal fillet welds along the sides and transverse fillet welds across the ends of the channels had the greatest fatigue strength. The fatigue strength was somewhat lower for a channel box section connected to gusset plates by fillet welds than for two channels back-to-back connected with similar fillet welds to a gusset plate between them. Peening increased the fatigue strength of transverse fillet welds and decreased that of longitudinal fillet welds. In tests to determine the fatigue strength in shear of the plug-welds connecting plates, a small increase of fatigue strength occurred with increase in thickness of the outside plates, while there was a slight decrease in the fatigue strength of the plugs with increase in their diameter. A. C. W.

539.434 : 666.1 323

The glassy matrix in tank blocks. PARTRIDGE, J. H., AND SEAL, K. *J. Soc. Glass Technol.*, 28, *pp.* 119–132, *April*, 1944.—Specimens cut from refractory blocks employed in the walls of glass tank furnaces have been subjected to a small tensile stress of 500 g./cm.^{2} at 1 350° for long periods. Some specimens extended rapidly and failed in a few hours; others more slowly and had not failed after 300 hr. Differences in the nature of the glassy matrix account for the different behaviour of these specimens; the face of a tank block exposed to molten glass consists of crystals set in a matrix which must be a viscous glass rather than a solid at the temperatures of tank furnace operation. The effect of an addition of substances to sillimanite-clay mixtures to produce denser tank blocks and to promote crystallization of mullite was investigated from the point of view of resistance to creep at high temp. and to corrosion by molten glass.

539.501 324

A molecular theory of the viscoelastic behaviour of an amorphous linear polymer. ALFREY, T. *J. Chem. Phys.*, 12, *pp.* 374–379, *Sept.*, 1944.—The distribution of relative displacements of every chain atom and the rate of approach to elastic equilibrium, as well as the equilibrium itself, are considered. As a first approximation, it is predicted that a linear amorphous polymer will possess a distribution of elastic retardation times of the form $J(\tau)d\tau = (C \log \tau - D)d \log \tau$, where C and D are constants characteristic of the material.

539.501 325

Some applications of the Nutting–Scott-Blair equation. BILMES, L. *J. Sci. Instrum.*, 21, *pp.* 183–185, *Oct.*, 1944.—The Nutting–Scott-Blair equation is applied to extension or compression under const. load, torsion of cylinders and deformation in a capillary tube. The equations obtained contain as special cases the formulae given by elasticity and viscosity theory. The close analogy existing between the equations obtained (when $\beta = 1$) and elasticity and viscosity formulae is pointed out and the method of conversion is indicated.

539.501 : 667.5 326

Relationship of ink to paper. REID, J. F. *Pulp Pap. Mag. Can.*, 45, 3, *pp.* 189–190, 1944.—Factors affecting the printing value of ink and the printability of paper are discussed. The force which must be applied to an ink to cause it just to flow under printing conditions (the yield value) acts, with the thixotropy value, oppositely to the fluidity of the ink. This explains why freedom from mottle can be obtained with an ink of high fluidity on a hard non-

absorbent paper, although an ink of high yield value and fluidity tends to be short and buttery and to distribute badly. J. G.

541.12.032 327

Nature and measure of agitation. HIXSON, A. W. *Industr. Engng Chem.*, 36, *pp.* 488–496, *June*, 1944.—Discusses the criteria of agitation and gives a résumé of previous work in the field, such as attempts to evaluate and relate the factors required to produce an arbitrary std. result, e.g. a definite dispersion of a finely divided solid in a liquid (mixing index), the dispersion of an immiscible liquid (std. emulsions) in another liquid, a definite rate of solution of a solid in a liquid (intensity of agitation). H. H. HO.

541.12.032 328

A mass-velocity theory for liquid agitation. MILLER, F. D., AND RUSHTON, J. H. *Industr. Engng Chem.*, 36, *pp.* 499–503, *June*, 1944.—The operation of agitation is appraised from the standpoint of 2 types of interrelated actions: (1) those characteristic of the impeller and stream discharged by it, and (2) those dependent upon the nature of fluid flow required to produce the desired result in the fluid. The amount and speed of flow required for a given result are controlled by the physical properties of the fluids, solids or gases, to be handled. Data are given showing the relation of the discharge characteristics and power required for several sizes of impellers. Methods for evaluation of impeller performance and action of the discharge stream are proposed. Means for evaluating agitation requirements are discussed, and examples are given for operations such as maintaining or producing suspensions which show how an impeller can be selected to produce a desired result once the agitation requirements are determined. H. H. HO.

541.12.032 : 542.231.8 329

Performance of agitated gas-liquid contactors. COOPER, C. M., FERNSTROM, G. A., AND MILLER, S. A. *Industr. Engng Chem.*, 36, *pp.* 504–509, *June*, 1944.—A method of studying the design variables pertinent to agitated gas-liquid reactors has been developed, in which the catalysed rate of air oxidation of aq. Na sulphite and the agitator power consumption are measured. Volumetric absorption coefficients for agitated contactors vary with (agitator power)$^{0\cdot95}$ and with (gas velocity)$^{0\cdot67}$, giving rise to a new function, absorption number, defined as $K_v/V_s^{0\cdot67}$, where K_v is the absorption coefficient and V_s is the average gas velocity based on the cross-section of the reactor. When plotted against agitator power input per unit vol. of liquid, this function correlates data for vaned-disc impellers and flat paddles covering, respectively, 3- and 10-fold variations of scale size. Power magnitudes ranging from 10 to 3 000 ft. lb./min./ft.^{3} and gas rates ranging from 20 to 360 ft./hr. are reported. Application to design variables is illustrated by data relating the performance of a laboratory reactor to liquid depth. A no-gas power correlation is presented for the vaned disc operating in a baffled tank. H. H. HO.

541.123.2 : 536.421.1 330

The system acetic-acid–ammonia. DAVIDSON, A. W., SISLER, H. H., AND STOENNER, R. *J. Amer. Chem. Soc.*, 66, *pp.* 779–782, *May*, 1944.—The temp./conc. curve for the system was completed throughout the entire conc. range. The m.p. of pure anhydrous ammonium acetate is 117°.

541.123.2 : 536.77 *see Abstr.* 229

541.123.31 331

The ternary system silver-bromate–sodium-bromate–water. RICCI, J. E., AND ALESHNICK, J. J. *J. Amer. Chem. Soc.*, 66, *pp.* 980–983, *June*, 1944.—The system was studied in detail at 25°, and, partially, at 50° and 5° C. The salts form a definite compound, $AgBrO_3 . NaBrO_3$, which forms a continuous solid solution with $AgBrO_3$. $NaBrO_3$ also forms a solid solution containing up to 2·5–3·0% of $AgBrO_3$. The results may explain the great variation in the values of the solubility of $AgBrO_3$ reported in the literature, and suggest that samples of the salt used may have been contaminated with $NaBrO_3$.

541.123.31 332

The system magnesium-selenate–selenic-acid–water at 30°C. FURUKAWA, H., AND KING, G. B. *J. Phys. Chem.*, 48, *pp.* 174–178, *July*, 1944.—Four solid phases, $MgSeO_4 . 6H_2O$, $MgSeO_4 . 4H_2O$, $MgSeO_4 . H_2SeO_2 . 6H_2O$, and probably $MgSeO_4$, are in equilibrium with solutions of selenic acid at this temperature.

541.123.31 : 523.739.2 333

The ternary system barium-bromate–barium-chlorate–water at 25°. RICCI, J. E., AND SMILEY, S. H. *J. Amer. Chem. Soc.*, 66, *pp.* 1011–1015, *June*, 1944.—The formation of a continuous solid solution of the monohydrates of the 2 salts at this temperature explains the difficulties in the attempted analytical determination of bromate in the presence of chlorate by precipitation with excess of Ba salt ($BaCl_2$). The system belongs to Type II of Roozeboom's classification of solid solutions, involving positive deviations from ideality. The distribution const. for the two isomorphous salts between their aq. solutions and the saturating solid solution was determined from a plot of the data. Log K so found $= 2\cdot0_0$, in agreement with the value calculated from the separate aq. solubilities of the two salts, log $K = 1\cdot8_1$. The disagreement between calculated and observed distribution const. is attributed to uncertainty of the activity coeff. for $Ba(ClO_3)_2 . H_2O$; the distribution const. derived from this type of equilibrium study may be used for the calculation of such an activity coeff.

541.123.31 : 532.739.2 334

The systems $NaClO_3$–NaBr–H_2O, $NaClO_3$–NaI–H_2O and $NaClO_3$–$NaNO_3$–H_2O, at 25°C. RICCI, J. E. *J. Amer. Chem. Soc.*, 66, *pp.* 1015–1016, *June*, 1944.—Solubility measurements are given for the systems $NaClO_3$–NaBr–H_2O, $NaClO_3$–NaI–H_2O and $NaClO_3$–$NaNO_3$–H_2O, at 25°. These salt pairs form neither double salts nor solid solutions at this temperature.

541.124 335

The hydrolysis of trimethylethylene bromide. Mechanism of ketone formation. SUTER, C. M., AND ZOOK, H. D. *J. Amer. Chem. Soc.*, 66, *pp.* 738–742, *May*, 1944.—The mechanism by which trimethylethylene bromide is converted into methyl isopropyl ketone proceeds in steps through trimethylethylene bromohydrin and trimethylethylene glycol, as evidenced by rate measurements on the hydrolysis of the bromide and bromohydrin and on the conversion of

glycol to ketone. Preliminary experiments with isobutylene bromide indicate that a similar mechanism holds for the hydrolysis of this compound.

541.124 336

Rearrangement of alkyl halides. MAYO, F. R., AND DOLNICK, A. A. *J. Amer. Chem. Soc.*, 66, *pp.* 985–990, *June*, 1944.—The liquid-phase rearrangement of the bromopropanes to an equilibrium mixture was studied. Analogies between this reaction and the addition of HBr to alkenes suggest that rearrangement of an alkyl bromide occurs by loss and readdition of HBr and that the reactions proceed by (1) a non-chain mechanism accelerated by soluble bromide salts or HBr and retarded by substances which remove HBr, (2) an atom-chain mechanism accelerated by O and inhibited by antioxidants. Alkyl chlorides rearrange by the non-chain mechanism.

541.124 337

The kinetics of anionotropic rearrangement. I. The rearrangement of propenylethynylcarbinol. BRAUDE, E. A., AND JONES, E. R. H. **II. Medium effects in the oxotropy of propenylethynylcarbinol. The determination of isodielectric energies of activation.** BRAUDE, E. A. *J. Chem. Soc.*, *pp.* 436–449, *Sept.*, 1944.—A kinetic study of the acid-catalysed anionotropic rearrangement: $CH_3 . CH : CH . CH(OH) . C \vdots CH \rightarrow CH_3 . CH(OH) . CH : CH . C \vdots CH$ was made, the course of the reaction being followed by measuring the changing absorption of ultra-violet light. In aq. solution containing 20% by vol. of alcohol, the reaction is of the first order, the rate being independent of the initial conc. of the carbinol, of the *p*H at low, and to Hammett's acidity function at high acidities, and almost identical with the rate of racemization. The salt effect is positive. The experimental energy of activation varies from 19 to 24 kg./cal. over a wide range of conditions. The mechanism of the reaction is discussed with ref. to current theories of anionotropy.—The rearrangement of the oxonium ion ROH_2^+, not the preceding proton-transfer reaction, appears to be the rate-determining step. A method is outlined for the calculation of isodielectric energies of activation, the values obtained being 4 to 10 kg./cal. higher than the experimental energies of activation and practically independent of the composition of the aq.-alcoholic solvent.

541.124 : 535.342 338

A spectrographic and kinetic study of the alkaline fading of tetraiodophenolsulphonphthalein. AMIS, E. S., AND OVERMAN, R. T. *J. Amer. Chem. Soc.*, 66, *pp.* 941–945, *June*, 1944.—The absorption of alkaline-faded iodophenol blue approximates that of alcohol acids and H_2O, as would be expected if the carbinol is formed during fading. Spectra of the unfaded and regenerated acid solution are identical and the fading process appears to be reversed in acid solution. The absorption band is only lowered in intensity during fading. Addition of NaI influences the kinetics of fading by the Brønsted primary salt effect. Fading appears to consist of transformation from the quinonoid to the carbinol structure. W. R. A.

541.124 : 541.145 339

The reaction of hydrogen atoms with acetylene. LEROY, D. J., AND STEACIE, E. W. R. *J. Chem. Phys.*, 12, *pp.* 369–373, *Sept.*, 1944.—With the large H-atom conc. produced in the discharge tube, catalytic recombination of H atoms occurs but no hydrogenated products could be detected. With small H-atom conc. resulting from Mg photosensitization, ethane and butane are produced together with a partially hydrogenated polymer. The results are discussed from the point of view of the elementary reactions involved and it is concluded that ethyl and vinyl radicals play an important part in the reaction.

541.124 : 541.64 340

Mechanism of peroxide-initiated styrene polymerization. PFANN, H. F., SALLEY, D. J., AND MARK, H. *J. Amer. Chem. Soc.*, 66, *pp.* 983–985, *June*, 1944.—The Br content in polymers obtained from liquid styrene and *p*-bromobenzoyl peroxide at various temp. was determined gravimetrically and with the aid of Br^*. Values from the two methods agree and indicate between 1 and 3 Br atoms per chain. W. R. A.

541.124 = 3 341

The homogeneous thermic decomposition of cyclopentane. KÜCHLER, L. *Z. phys. Chem. B*, 53, *pp.* 307–319, *July*, 1943.—The rate of decomposition was investigated by a static method. The reaction products separated by desorption were analysed. The decomposition appears partly as dehydration under formation of C_5H_6 and partly as splitting of the ring which leads to the formation of C_2H_4 and C_3H_6. Dehydration occurs in 2 steps by way of C_5H_8. The first step determines the rate of decomposition. The heat of activation is 75 kcal. The splitting of the ring shows an autocatalytic character. A tentative explanation is given. Chain reaction is improbable. R. N.

541.124.7 342

The kinetics of aromatic sulphonation reactions: the sulphonation of *p*-nitrotoluene and of chlorobenzene by sulphur trioxide. WADSWORTH, K. D., AND HINSHELWOOD, C. N. *J. Chem. Soc.*, *pp.* 469–473, *Sept.*, 1944.—Both reactions show characteristics similar to those found in the sulphonation of nitrobenzene, being of the second order with respect to S_2O_6 and exhibiting a strong retardation due to the formation of a complex between S_2O_6 and the sulphonic acid produced. The activation energies and log *PZ* factors were for *p*-nitrotoluene 11 025 cal. and 4·78 respectively, and for chlorobenzene 7 720 cal. and 5·14, compared with 11 400 cal. and 3·91 for nitrobenzene.

541.124.7 343

The thermal decomposition of potassium permanganate. PROUT, E. G., AND TOMPKINS, F. C. *Trans. Faraday Soc.*, 40, *pp.* 488–498, *Nov.*, 1944.—The thermal decomposition of whole and ground crystals of $KMnO_4$ was studied in the range 200°–225°C., and activation energies for both acceleratory and decay coefficients are calculated. An equation, which has the form of a modified auto-catalytic expression, is applicable and a theory is postulated which leads to the correct relation.

541.124.7 : 536.666 : 535.343.4 344

The dissociation of H_2O into H + OH. DWYER, R. J., AND OLDENBERG, O. *J. Chem. Phys.*, 12, *pp.* 351–361, *Sept.*, 1944.—A spectrograph of high resolving power served for the measurement of the

intensity of the absorption spectrum of OH in a heated mixture of water vapour and oxygen. The result (for 0°K.) was $H + OH \rightarrow H_2O - (118{\cdot}2 \pm 0{\cdot}7)$ kcal. and $O + H \rightarrow OH - (100{\cdot}1 \pm 0{\cdot}9)$ kcal. The probabilities of transition of the lines of the OH band were recomputed. [See Abstr. 309 (1939)].

541.124.7 : 541.127.1 *see Abstr.* 349

541.127 345

The kinetics of the reaction between silver perchlorate and methyl iodide. REDIES, M. F., AND IREDALE, T. *J. Phys. Chem.*, 48, *pp.* 224–230, *Aug.*, 1944.—The reaction between Ag salts and alkyl iodides in various solvents appears to be of the $2\frac{1}{2}$ order, the kinetics assuming a modified, pseudo-bimolecular form, in which k_2 is $\propto a^{\frac{1}{2}}$ (a = initial Ag salt conc.) at lower concentrations. The energies of activation are of the order 11 000 to 13 000 calories.

541.127 346

The kinetics of the reaction between chlorine and nitric oxide. STODDART, E. M. *J. Chem. Soc.*, *pp.* 388–393, *Aug.*, 1944.—Previous experiments have shown that this reaction is influenced by surface conditions, adsorption of the nitrosyl chloride formed during the reaction inhibiting the change. The present work shows that the velocity const. of the reaction diminishes from experiment to experiment, as well as during each experiment, owing to an ageing effect of the reaction vessel. The original state of the surface cannot be recovered by mere pumping or by baking under vacuum, although the latter procedure is more efficacious than the former. Drying prevents inhibition, and it is concluded that the ageing and inhibitory effects are due to the activated adsorption or chemisorption of nitrosyl chloride on the adsorbed moisture of the wall of the reaction vessel.

541.127 : 536.423 347

Increase in concentration of insecticide in Freon-12. SMITH, C. M., AND GOODHUE, L. D. *Industr. Engng Chem.* (*Analyt. Edit.*), 16, *pp.* 355–357, *June*, 1944.—In the transfer or discharge of solutions in liquefied gases used for the production of insecticidal aerosols, a concentrating effect occurs because of escape of solvent from the solution to maintain the high vapour density. A mathematical treatment of this effect is given, and experiments are described by which it was confirmed for solutions in Freon-12. In that case a discharge of 90% of the liquid phase raises the conc. of the remaining solution by 8% of its value.

541.127 : 541.128 348

The effect of dielectric constant and temperature on the catalysed decomposition of azodicarbonate ion. KING, C. V., AND JOSEPHS, J. J. *J. Amer. Chem. Soc.*, 66, *pp.* 767–771, *May*, 1944.—The rate of decomposition of the azodicarbonate ion was determined at 5 temperatures from 15° to 35° in dil. aq. NaOH and in dil. aq. NaOH + dioxane (up to 60%). Molar H^* catalysis const. at zero ionic strength, calculated from these rates, vary with the permittivity of the medium in agreement with theoretical predictions. Temp. coeff., energies and entropies of activation are calculated and agree with values obtained from the Eyring abs. rate and collision-rate theories. W. R. A.

541.127 : 676.11 : 541.144.8 *see Abstr.* 362

541.127.1 : 541.124.7 349

The reaction of dibromides of mono-substituted ethylenes with potassium iodide. PRESSMAN, D., AND YOUNG, W. G. *J. Amer. Chem. Soc.*, 66, *pp.* 705–709, *May*, 1944.—The reaction rate constants and the heats and entropies of activation were determined for the reaction in 99% methanol of KI with $RCHBrCH_2Br$ where R was C_3H_7, C_6H_5, $C_6H_5CH_2$, CH_2OH, COOH and Br. Since each of the Br atoms can react and at a different rate and with a different heat of activation, no theoretical significance can be given to the effect of various substituents, R, on the observed values of the heats of activation.

541.127.1 : 541.132 *see Abstr.* 354

541.128 350

The metal-catalysed reaction between acetylene and hydrogen. I. Nickel catalysts. SHERIDAN, J. *J. Chem. Soc.*, pp. 373–380, *Aug.*, 1944.—The rate of fall in total pressure in $H\text{-}C_2H_2$ mixtures over Ni-pumice catalysts increases, under const. conditions, during the early stages of use of the catalysts. The yields of ethylene, ethane and higher hydrocarbons, expressed in terms of the C_2H_2 not recovered, are the same on fresh and old catalysts. The course of reaction in 1 : 1 and 2 : 1 $H : C_2H_2$ mixtures on catalysts of const. activity is plotted. The products other than C_2 hydrocarbons have an empirical gross composition of about C_4H_7, and are formed in yields of 55–60% of the C_2H_2 not recovered at all stages of reaction, with both gas ratios. The initial reaction on catalysts of const. activity is of first order with resp. to H and of approx. zero order with respect to C_2H_2. The hydrogenation to ethylene and the formation of reduced polymers of acetylene both have kinetics of approx. this type, but differing slightly such that an increase from 1 : 8 to 8 : 1 in initial $H : C_2H_2$ ratio causes an increase from 40% to 67% in the yield of C_2 hydrocarbons. Ethylene added to the system acts as an inert diluent, and is less strongly adsorbed than C_2H_2 on Ni. The same catalysts have negligible action on C_2H_2 alone.

541.128 : 541.127 *see Abstr.* 348

541.128.13 = 3 351

On the joint action of flow, diffusion and chemical reaction in heterogeneous catalysis. WAGNER, C. *Z. phys. Chem.*, 193, *pp.* 1–15, *Oct.*, 1943.—A theory is developed for determining the temporal and local differences of conc. between the inside of contact-dispersed catalyst grains and the flowing gas. Under laboratory conditions and in technical NH_3 catalysis with sufficient surface diffusion [Abstr. 1255 (1942)], the differences are small. In the technical catalysis, larger differences are to be expected only if the surface diffusion is negligible. R. N.

541.128.24 352

Oxidation processes. XVII. The autoxidation of ascorbic acid in the presence of copper. WEISSBERGER, A., AND LUVALLE, J. E. *J. Amer. Chem. Soc.*, 66, *pp.* 700–705, *May*, 1944.—The autoxidation rate of *l*-ascorbic acid in the presence of Cu (2×10^{-5} mole/l.) is investigated from *p*H 2·59 to 9·31. The results agree with the assumption that in the primary reaction, one mole of dehydroascorbic acid and of H_2O_2 is formed from one mole of ascorbic acid and O

The rate is independent of the ascorbic acid conc. and ∝ O conc. [Abstr. 287 (1944)]. At very low Cu conc. the rate increases faster than the conc. of the metal. At higher conc. of the latter the rate increase becomes ∝ increase in the Cu conc. Only the monovalent ion of *l*-ascorbic acid is the substrate of the Cu catalysis, and the apparent irregularity in the dependence of the rate on *p*H is caused by complex formation of some of the buffers with the Cu catalyst.

541.128.3 : 538.214 *see Abstr.* 276

541.128.5 353

On the poisoning of metallic catalysts. HERINGTON, E. F. G., AND RIDEAL, E. K. *Trans. Faraday Soc.*, 40, *pp.* 505–516, *Nov.*, 1944.—The variation of reaction rate which would arise if catalysis were proceeding on a uniform set of sites is examined. This model is capable of reproducing much of the observed behaviour so that an explanation of catalysts requiring active spots would in many cases appear to be unnecessary. Some of the complications which may arise in studying catalyst poisoning are discussed, and it is shown that additional factors may operate in flow systems. H. H. HO.

541.132 : 541.127.1 354

The ionization constants of very weak acids. Acetoxime, methyl ethyl and diethyl ketoximes. KING, C. V., AND MARION, A. P. *J. Amer. Chem. Soc.*, 66, *pp.* 977–980, *June*, 1944.—The rate of decomposition of nitrosotriacetonamine, catalysed by OH′, was measured as a function of ionic strength (μ) at 24·9°C. up to [OH′] = 0·05 and μ = 0·22 and may be expressed as $k = (1{\cdot}209 - 0{\cdot}479\,\mu)$[OH′]. The acid dissociation const. of the ketoximes were determined as a function of the ionic strength, using the catalytic reaction above to measure the [OH′] of NaOH partially neutralized by ketoxime. W. R. A.

541.132.3 355

Borax as a standard buffer solution. LAUCHLAN, A. D. E. *Nature, Lond.*, 154, *p.* 577, *Nov.* 4, 1944.

541.135.5 356

A comparison of platinum and palladium hydrogen-electrodes in aqueous solutions of acid potassium phthalate. HAMER, W. J., AND ACREE, S. F. *J. Res. Nat. Bur. Stand., Wash.*, 33, *pp.* 87–104, *Aug.*, 1944.—A study was made of the reproducibility of H electrodes of various types and of Ag/AgCl electrodes of the thermal-electrolytic type in aq. solutions of phthalates. The potentials of H electrodes prepared with Pt sponge under a variety of conditions increased with time and frequently were erratic, whereas those made with Pd sponge under different conditions remained const. for periods of 35 hr. Pa or Pt electrodes having the same type of coating but of different ages agreed in potential after 2 hr in phthalate solutions. The rate and the magnitude of the increase in potential for the Pt electrodes after approx. 2 hr. depend mainly upon the thickness of the metallic sponge. The characteristics of the Pd electrodes were independent of thickness of the sponge, c.d. used in the electrolysis, conc., composition, acidity and conductance of the plating solution, and of the conc., composition, *p*H and buffer capacity of the phthalate solutions in which the electrodes were used.

541.135.5 : 532.66 *see Abstr.* 132

541.135.8 : 621.357.1 = 3 357

The part played by inhibitors at the electrolytic separation of metals. II. FISCHER, H. *Kolloidzschr.*, 106, *pp.* 50–62, *Jan.*, 1944.—[Abstr. 137 B (1945)].

541.138.3 358

The reduction potential of acridines, with reference to their antiseptic activity. BREYER, B., BUCHANAN, G. S., AND DUEWELL, H. *J. Chem. Soc., pp.* 360–363, *Aug.*, 1944.—The acridines are reduced in 2 stages, the first leading to the formation of a monohydroacridine radical, the second to dihydroacridine. Diffusion currents and concentrates of most acridines are mutually proportional in solutions from 10^{-3} to 10^{-5} *M*. The reduction potentials were measured through the *p*H range from 2 to 12; this property is correlated with the known relationship between deg. of dissociation and biological activity of acridines. Those members having a more neg. reduction potential than − 0·400 V (against the normal H electrode) at *p*H 7·3 are most active biologically.

541.141 : 539.172 *see Abstr.* 296

541.141.1 359

Photochemical reactions. VIII. Reaction of ethylenes with phenanthraquinone. SCHÖNBERG, A., AND MUSTAFA, A. *J. Chem. Soc., p.* 387, *Aug.*, 1944.—[See Abstr. 1426 (1944)]. The reactions of phenanthraquinone with styrene, stilbene, α α-diphenylethylene and triphenylethylene in sunlight are described. The products are probably derivatives of 2 : 3-dihydro-1 : 4-dioxane.

541.144.8 360

Photochemical studies. XXXVII. Some tests of mechanism for the photochemical decomposition of acetone. HOWLAND, J. J., JR., AND NOYES, W. A., JR. *J. Amer. Chem. Soc.*, 66, *pp.* 974–977, *June*, 1944.—The photochemical decomposition of $COMe_2$ was investigated at 27°C., using λλ2 500–2 700 and 3 130 Å and various pressures. The quantum yield diminishes with increasing intensity at all wavelengths. Decrease in the size of the reaction vessel leads to an increase in C_2H_6/CO ratio; this ratio is diminished with increasing pressure at high intensity. These data are discussed [Abstr. 2605 (1941)]. W. R. A.

541.144.8 361

The asymmetric photolysis of β-chloro-β-nitroso-αδ-diphenylbutane with circularly polarized light. MITCHELL, S., AND DAWSON, I. M. *J. Chem. Soc., pp.* 452–454, *Sept.*, 1944.—The compound (in methyl alcohol) was irradiated with right-handed circularly polarized red light until about 90% of it had been decomposed. The unattacked portion was recovered and showed $\alpha_{5\,300}^{20°} = -0{\cdot}10°$ ($l = 1$, $c = 4\%$ in methyl alcohol). A corresponding experiment with left-handed light gave the value + 0·11°.

541.144.8 : 541.127 : 676.11 362

The action of ultra-violet light upon cellulose. I. Irradiation effects. II. Post-irradiation effects. STILLINGS, R. A., AND NOSTRAND, R. J. VAN. *J. Amer. Chem. Soc.*, 66, *pp.* 753–760, *May*, 1944.—Apparatus, suitable for the ultra-violet irradiation of powdered solids in various atmospheres and providing for evacuation prior to exposure, continuous mixing and continuous analysis of gaseous products, is described. Cellulose in N_2 is considerably degraded

(lowering of degree of polymerization and α-cellulose content, increase in Cu no. and liberation of CO and CO_2), the degradation increasing with time of exposure. These changes are not related to the presence of O_2 in the N_2 or in the cellulose. The rate of degradation increases with increasing O_2 in the atmosphere. But rate of change of chain length and Cu no. do not correspond with a first-order reaction rate. β-*d*-glucose and cellobiose liberate CO and CO_2 but more slowly than cellulose. If cellulose which has been irradiated in the absence of O_2 is left in air, the changes brought about by irradiation continue, but cease when air is absent. Post-irradiation effects are enhanced by increased temperature to 70° and by O_2 instead of air, but diminished on replacement of O_2 by N_2. Re-introduction of O_2 caused production of post-irradiation effects. For cellulose irradiated in O_2, the post-irradiation effects were less marked and of shorter duration. W. R. A.

541.144.8 : 577.16B_2 363

Photochemical destruction of vitamin B_2 in milk. ZIEGLER, J. A. *J. Amer. Chem. Soc.*, 66, *pp.* 1039–1040, *June*, 1944.

541.145 : 541.124 *see Abstr.* 339

541.18 : 615.37 364

Protective colloids in cancer. MUNRO, L. A. *J. Phys. Chem.*, 48, *pp.* 187–195, *July*, 1944.—The protective colloids of 78 cancer sera were compared with normal sera from 70 individuals. The addition of 0·075 ml. of serum is made to 5 ml. of Congo red and after addition of the coagulating electrolyte and incubation at 30°C. for 30 min., the residual colour is determined in a photo-electric colorimeter. Average values of 9·26 and 40·52 γ per ml., respectively, were obtained, 89·6% of the cancer patients and 4·3% of normals giving values below 15 γ/ml. The *A*/*G* ratio shows a rather poor parallel to the protective colloid index. It is suggested that other factors such as molecular dispersity and even molecular species are more important.

541.182.025 : 532.613.2 = 3 365

On the theory of thixotropy. VON ENGELHARDT, W. *Kolloidzschr.*, 102, *pp.* 217–232, *March*, 1943.—An explanation is given of the parallelism between the degree of thixotropy of Kaolinide in various liquids and the grinding hardness of quartz suspended in colloidal dispersion in the same liquids. Both values depend on the polar properties of the liquid. The higher the liquid particles are polarized in the solid/liquid interface field, the smaller is the thixotropy. The interface tension solid/liquid, and therefore the grinding hardness, is the higher the less the liquid is polarized in the interface field. The behaviour of various solid materials suspended in the same liquid depends largely on the shape of the particles. It is assumed that the attractive forces are of the van der Waals type and therefore depend on volume, while the repulsive forces are caused by surface charges. R. N.

541.182.04 : 536.658 = 3 *see Abstr.* 223

541.182.4 : 532.695.1 *see Abstr.* 135

541.183 : 531.72 *see Abstr.* 108

541.183 : 531.724 *see Abstr.* 110

541.183.1 : 536.658 366

Cluster formation and phase transitions in the adsorbed state. CASSEL, H. M. *J. Phys. Chem.*, 48, *pp.* 195–202, *July*, 1944.—On plane surfaces, mutual attraction and cluster formation manifest themselves in the shape of adsorption isotherms as a convexity against and as an osculation of the pressure axis. A van der Waals equation of state for monolayers and the corresponding equation for the coexisting volume phases being assumed, a relation between the critical temperatures of 2- and 3-dimensional condensation is derived. For London dispersion forces, $T_2 = \frac{1}{2}T_3$. The possible discontinuities in the transition from the adsorbed gaseous to the liquid state in bulk are discussed, and the hysteresis in sorption–desorption processes is interpreted as a supersaturation phenomenon. The occurrence of knee-points in adsorption isotherms on powdered materials is reinterpreted as an effect of active areas.

541.183.2 : 532.614.2.08 367

The properties of freshly formed surfaces. III. The mechanism of adsorption, with particular reference to the *sec.*-octyl-alcohol–water system. ADDISON, C. C. *J. Chem. Soc.*, *pp.* 477–480, *Sept.*, 1944.—[See Abstr. 105, 2301 (1944)]. Dynamic surface tensions of aq. *sec.*-octyl alcohol solutions were measured by the vibrating-jet method. The extent to which the free energy of the surface can be reduced by the adsorbate at any given conc. is the major factor controlling the velocity at which the adsorbate molecules migrate to the surface; the variation in true velocity during adsorption is determined.

541.183.53 : 536.655 : 532.62 368

Surface of solids. X. Extension of the attractive energy of a solid into an adjacent liquid or film, the decrease of energy with distance, and the thickness of films. HARKINS, W. D., AND JURA, G. *J. Amer. Chem. Soc.*, 66, *pp.* 919–927, *June*, 1944.—[See Abstr. 840 (1944)]. Practically every film adsorbed on the surface of non-porous solids is highly polymolecular at v.p. slightly < saturation. The effect of distance on the intermolecular attraction between a solid and an adjacent liquid or an adsorbed layer was determined in energy units. The energy decays exponentially with distance. The energy of vaporization of H_2O at 25°C.! (Q) is 10 540 g. cal./mol. If the water is adsorbed on a clean surface of cryst.TiO_2 (anatase), this energy is increased by amounts depending on the number of layers of H_2O adsorbed, the values for 1, 2, 3, 4 and 5 layers being 6 550, 1 380, 450, 80 and 40 g. cal./mol. $> Q$. Consequently, at least 5 mol. layers of H_2O should be adsorbed on anatase before saturation of the vapour is attained and experimental evidence shows thicknesses of > 15 Å. With N_2 at − 195·6°, the measured thickness is 36 Å (10 mol. layers). At 0°C. *n* − C_4H_{10} attains a thickness of 64 Å, but the thickness of the first mol. layer is ~ 4 Å since the mols. lie flat on the surface. Until about the seventh layer, the degree of orientation is small, but thereafter the surface of the film should exhibit the same orientation as liquid *n*–C_4H_{10}. These results are not in accord with Langmuir's theory of monomolecular layers, or the combined monolayer plus capillary condensation theory. They show that films adsorbed on plain surfaces usually

attain greater thicknesses than on porous solids, but $Pr^{n}OH$ on $BaSO_4$ is an exception and H_2O on hydrophobic solids should also be an exception. Whilst these results agree with the multi-molecular theory, the assumption that the energy of vaporization of the second adsorbed layer is $>$ the energy of vaporization of the liquid is incorrect. Capillary condensation does not play an important rôle in the sorption with cryst. powders of the type used. W. R. A.

541.24 369

Molecular weight by isothermic distillation. Niederl, J. B., and Kasanof, D. R. *Science*, 100, *p.* 228, *Sept.* 8, 1944.—The apparatus consists of a capillary desiccator tube and 2 capillaries, each 25 mm. long and 1·5 mm. inner dia., A and B. Capillary A contains the std. solution, B contains the unknown. The sealed desiccator tube is mounted on a microscope slide. The solutions of std. and unknown are placed in competition for solvent through a short vapour bridge in obedience to Raoult's law.

541.24 : 661.713 : 541.64 : 532.133 *see Abstr.* 119

541.265 370

Molecular volume and structure. VII and VIII. Gibling, T. W. *J. Chem. Soc.*, *pp.* 380–385, *Aug.*, 1944.—Slight modification of 2 group values and one interference correction previously assessed [Abstr. 2056 (1943)] is necessitated by recent determinations, and the parachors of aldehydes, ketones and esters of fatty acids are reconsidered, as well as those of certain esters and ethers containing olefinic groups. Cyclic paraffins and olefins are considered in further detail. The variation of parachor with temperature in the case of certain normal liquids is discussed with sp. ref. to the anhydrides of fatty acids. The parachors of alkyl sulphides, thiols and disulphides are considered, and group values are estimated. It is suggested that the interference corrections, varying from member to member, which are required for the parachors of mercury alkylmercaptides, afford evidence of the structure of these compounds. The structures of alkyl sulphites are similar to those of the corresponding alkyl carbonates, and those of sulphates and phosphates appear to belong to the same type as the sulphites.

541.265 : 532.612 : 532.14 : 535.324 371

A study of organic parachors. VI. A supplementary series of tertiary alcohols. Quayle, O. R., and Smart, K. O. **VII. A series of saturated hydrocarbons.** Quayle, O. R., Day, R. A., and Brown, G. M. *J. Amer. Chem. Soc.*, 66, *pp.* 935–941, *June*, 1944.—VI. Experimental values of refr. index, densities, surface tensions and parachor, of 9 tertiary alcohols agree with calculated values. Tables for the estimation of parachors of tertiary alcohols, and position values of CH_2 in alkyl chains, are given. Modifications in the bubbler for measuring surface tension are described.—VII. Values for 13 paraffin hydrocarbons are given. Parachor values are given for CH_2 (40), H (15·5), and C (9·0). The value for CH_2 is not changed by chain length up to $C_{12}H_{26}$. Chain-branching does not produce uniform effects but the data are inadequate to evaluate variations in the effect. W. R. A.

541.265 : 541.636 *see Abstr.* 374

541.57 : 539.133 372

Molecular constants and chemical theories. III. Bond moments of higher valence states. Samuel, R. *J. Chem. Phys.*, 12, *pp.* 380–390, *Sept.*, 1944.—[See Abstr. 2304 (1944)]. Bond moments are calculated for such molecules as are formed by a marked central atom in a higher state of valency. The bond moments are additive in the same molecule and unchanged from molecule to molecule as long as the multiplicity of the bond and the state of valency of either atom remain the same. This treatment makes possible the simple calculation of the total moments of a number of molecules formed by pentavalent N. Observable facts of dipole measurements are as well represented by the classical structures and their underlying concepts, as by any other theory of the covalent bond. Dipole moments do not provide any evidence of the existence of such linkages as a semipolar double bond or its wave-mechanical equivalent.

541.6 : 536.7 *see Abstr.* 227

541.636 : 536.7 373

An empirical correlation and method of calculation of barriers hindering internal rotation. Aston, J. G., Isserow, S., Szasz, G. J., and Kennedy, R. M. *J. Chem. Phys.*, 12, *pp.* 336–344, *Aug.*, 1944.—The barriers hindering internal rotation of methyl groups can be calculated by assuming that they are solely due to repulsion between H atoms according to the law $V_{ij} = 4{\cdot}99 \times 10^5/r_{ij}^5$. For dimethyl ether, dimethyl sulphide and propylene, the empirically calculated values are low. This discrepancy is discussed. This treatment is applied to ethyl and isopropyl alcohol and several normal paraffins. The resulting entropies, heat capacities and equilibrium constants, are compared with available experimental data.

541.636 : 541.265 374

Steric inhibition of resonance. I. The dichloronitrobenzenes. II. The *m*-xylidines and *N*-dimethyl-*m*-xylidines. Thomson, G. *J. Chem. Soc.*, *pp.* 404–410, *Aug.*, 1944.—The mol. solution volumes and mol. refractivities of the 6 isomeric dichloronitrobenzenes are interpreted as supporting the view that in 2 : 6-dichloronitrobenzene resonance between the nitro-group and the benzene nucleus is to a large extent inhibited and that even 1 Cl ortho to a nitro-group will have a certain inhibitory effect on the resonance. Variations in the parachors are of the same magnitude and sign as the variations in mol. solution volumes. Values found for their dipole moments are not inconsistent with this view. Corroboration of views expressed is given by the observation that the atomic refractivity of N in *N*-dimethyl-*m*-2-xylidine is lowered to nearly the value observed in aliphatic tertiary amines, whereas in *N*-dimethyl-*m*-5-xylidine it has the normal value for aromatic tertiary amines. An intermediate value is found in *N*-dimethyl-*m*-4-xylidine, in which one methyl group is ortho to the dimethylamino-group. The mol. solution volume of *N*-dimethyl-*m*-2-xylidine is higher than that of *N*-dimethyl-*m*-5-xylidine but indistinguishable from that of *N*-dimethyl-*m*-4-xylidine. The parachors of the *N*-dimethyl-*m*-xylidines decrease in the order *m*-5 > *m*-4 > *m*-2.

541.64 : 541.124 *see Abstr.* 340

541.64 : 541.24 : 661.713 : 532.133 *see Abstr.* 119

541.65 : 535.343–31 *see Abstr.* 179

541.653 : 535.56 *see Abstr.* 189

541.654 : 535.324 *see Abstr.* 170

541.67 : 537.226.2 *see Abstr.* 239, 240

541.68 : 532.133 : 539.133 = 3 375

Structural mechanics of highly elastic continua. VI. Viscosity and chemical constitution of micromolecular systems. UMSTÄTTER, H. *Kolloidzschr.*, 102, *pp.* 232–245, *March*, 1943.—[See Abstr. 1396 (1942)]. The viscosity/temperature function at const. vol. is derived by substituting the time parameter of Newton's cooling law in Maxwell's viscosity equation. Upper and lower critical temperatures, the latter being that at which the liquid will cease to flow even under highest negative pressure, form the boundary conditions. Linear dimensions of micromolecular particles may be calculated with considerable accuracy from surface tension and shearing elasticity, relaxation time from surface tension and abs. mol. wt. Compounds with equal relaxation times are in general mutually soluble. A structural analysis of mixtures of hydrocarbons based on optical investigations is discussed. R. N.

542.231.8 : 541.12.032 *see Abstr.* 329

542.48 : 621.316.7 376

Automatic pressure regulation in vacuum distillation. COULSON, E. A., AND WARNE, R. J. *J. Sci. Instrum.*, 21, *pp.* 122–123, *July*, 1944.—A description is given of a method for controlling automatically the pressure in laboratory distillation apparatus of high fractionation efficiency (equiv. to betw. 50 and 100 theoretical plates). The method depends upon the use of a H_2SO_4 manostat, an electronic relay and a solenoid-operated air-valve. Constructional details are given for the two last-mentioned components. Over the range 700–70 mm. of Hg the pressure variation is limited to about 0·1% of any desired pre-set value.

542.61 : 532.739.2 *see Abstr.* 143

543.81 377

A physical method for determining residual water and other volatile materials in pure substances. SCHWAB, F. W., AND WICHERS, E. *J. Res. Nat. Bur. Stand., Wash.*, 33, *pp.* 121–129, *Aug.*, 1944.—The impurity is separated by fusing the substance in a cell attached to a collecting system and allowing it to freeze slowly while the vapours are collected by pumping them into a trap of known volume, cooled by liquid air. When the trap is warmed to room temperature, the pressure of the vapour within it, if below saturation, together with the temperature and volume, determine the quantity of impurity in terms of moles and, if its identity is known, in terms of weight. An auxiliary procedure permits the impurity to be isolated as a liquid, in a capillary container, and thus to be identified.

545 : 621.357.7.035.4 378

The estimation of ammonia in electrolysed cyanide plating solutions. BLOW, C. M., HISCOX, N. G., AND SMITH, M. W. *J. Electrodepos. Tech. Soc.*, 19, *pp.* 147–156, 1944.—[Abstr. 138 B (1945)].

545.37 379

Polarographic examination of carbonyl compounds. LUPTON, J. M., AND LYNCH, C. C. *J. Amer. Chem. Soc.*, 66, *pp.* 697–700, *May*, 1944.—Reduction of aldehydes and ketones in acid N_2H_4 was carried out polarographically using $Pr^{\beta}CHO$, Me_2CO, Me *n*-amyl ketone and $MeBu^{\beta}CO$ from 0·0001 to 0·01 M. Equations relating diffusion current and conc. are given. The precision is between 2 and 5%. W. R. A.

545.71 380

A simple analysis of the helium content of air. GLÜCKAUF, E. *Trans. Faraday Soc.*, 40, *pp.* 436–439, *Oct.*, 1944.

545.82 381

Infra-red analysis of butadiene. BRADY, L. J. *Industr. Engng Chem.* (*Analyt. Edit.*), 16, *pp.* 422–424, *July*, 1944.—Details are given of the infra-red technique involved where the concentration of only one component of a mixture is of interest. Refined butadiene may contain a number of impurities which absorb at a wavelength for which butadiene is relatively transparent. Determination of the impurity concentration allows of the butadiene content being determined by difference. A. H.

545.82 : 669.14 *see Abstr.* 421

545.824 : 548.73 *see Abstr.* 394

545.83 : 778 : 535.247.4 *see Abstr.* 165

545.844 : 535.321 *see Abstr.* 169

546.78 382

α-tungsten. PETCH, N. J., ROOKSBY, H. P. *Nature, Lond.*, 154, *pp.* 337–338, *Sept.* 9, 1944.

548.0 : 531.7 : 536.41 = 3 383

The lattice constants and coefficients of expansion of iodine. STRAUMANIS, M., AND SAUKA, J. *Z. phys. Chem. B*, 53, *pp.* 320–330, *July*, 1943.—The lattice constants and expansion coefficients of rhombic I crystals were determined at 3–4 const. temperatures [Abstr. 1551 (1943)]. At 18°C., $a = 4{\cdot}7761$ Å, $b = 7{\cdot}2501$ Å, $c = 9{\cdot}7711$ Å. The linear expansion coefficients are $\alpha_1 = 133{\cdot}4 \times 10^{-6}$, $\alpha_2 = 95 \times 10^{-6}$, $\alpha_3 = 35{\cdot}1 \times 10^{-6}$ and the cubic expansion coeff. $\beta = 264 \times 10^{-6}$. No monoclinic crystals could be established and, therefore, a transition point at 46·5°C. does not exist. The preparation of the crystals and the choice of radiation are discussed and the interferences observed are indicated on equatorial planes of the reciprocal lattice. R. N.

548.0 : 536.631 384

The specific heat of metals crystallizing in the cubic system. DAYAL, B. *Proc. Indian Acad. Sci. A*, 20, *pp.* 24–50, *July*, 1944.—Sp. ht. data for Al, Ag, Au, Cu and Pb (face-centred), Li, K, Na and W (body-centred) crystals have been evaluated by Raman dynamics of crystal lattice from known elastic constants and a Debye function representing the other degrees of freedom. Calculated and experimental values are in fair agreement. The accuracy with which sp. ht. data can be represented by a single Debye function is discussed. W. R. A.

548.0 : 621.794 : 535.21–31 *see Abstr.* 160

548.1 385

The space groups of $NiCl_2 . 6NH_3$, $NiBr_2 . 6NH_3$ and $NiI_2 . 6NH_3$. YU, S. H. *Sci. Rec., Acad. Sinica,*

1, 1–2, *p.* 151, *Aug.*, 1942.—It was formerly thought that crystals of these salts must have the symmetry of one of the space groups $Fm3(T_h^3)$, $F\bar{4}3(O^3)$ and $Fm3m(O_h^5)$ [*J. Amer. Chem. Soc.*, 44, p. 1239, 1922), *Nature*, 128, p. 410, 1931]. A discussion is given to show that there are reasons for concluding that the correct space group is $F\bar{4}3m$. L. S. G.

548.3 : 553.621 386

Orientation of the etching figures of quartz. CHOONG, S. P. *Nature, Lond.*, 154, *p.* 464, *Oct.* 7, 1944.

548.32 = 3 387

On the isomorphous interchange of the groups $-CH=CH-$ and $-CH_2=CH_2-$ (cinnamic acid and hydrocinnamic acid). KOFLER, A., AND BRANDSTÄTTER, M. *Z. phys. Chem.*, 192, *pp.* 71–75, *July*, 1943.—The fusion diagram of *trans*-cinnamic acid and hydrocinnamic acid is investigated. It consists of 3 parts, the middle of which is produced by a stable series of mixed crystals formed of 2 instable forms of the components. Of the other 2 series, one shows the structural type of the stable form of cinnamic acid, the other that of the stable form of hydrocinnamic acid. The transition points are located at 61°C. and 122°C. corresponding to 80% and 18% (wt.), respectively, of hydrocinnamic acid. R. N.

548.32 = 3 388

On the isomorphous interchange of the groups $-CH_2-CH_2-$, $-CH=CH-$, $-N=CH-$, $-N=N-$. BRANDSTÄTTER, M. *Z. phys. Chem.*, 192, *pp.* 76–81, *July*, 1943.—[See Abstr. 453 (1943)]. The structure of the miscibility types of benzalaniline with stilbene, azobenzene and dibenzyl, respectively, are investigated by Kofler's method [Abstr. 1444 (1943)] and their fusion diagrams are discussed.

R. N.

548.32 = 3 389

Isodimorphism in an alleged case of formation of mixed crystals of type Ia. BRANDSTÄTTER, M. *Z. phys. Chem.*, 192, *pp.* 82–84, *July*, 1943.—An investigation of the system *p*-bromoiodobenzene : *p*-diiodobenzene [Abstr. 1444 (1943)] shows that it is not of type Ia [Abstr. 1424 (1907)] (miscible without gap, with a point of inflection in the fusion diagram) but of type IV [Abstr. 678 (1900)], i.e. with a transition point. Thus a case of isodimorphism is apparent which was also proved by making a contact preparation. R. N.

548.55 : 548.73 *see Abstr.* 395

548.7 : 531.19 390

Note on Kirkwood's theory of superlattices. WANG, J. S. *Sci. Rec., Acad. Sinica*, 1, 1–2, *pp.* 116–120, *Aug.*, 1942.—The Kirkwood method of evaluating the partition function [Abstr. 928 (1938), 3858 (1939)] in the statistical theory of superlattices is based on the transformation

$$\log\left(\sum_{n=0}^{\infty} M_n x^n/n!\right) = \sum_{n=1}^{\infty} \lambda_n x^n/n!$$

where $M_n = \overline{X^n}$ is the nth moment. Here X is the number of pairs of atoms situated at neighbouring sites for any given configuration and the bar denotes an average over all possible configurations. There are two formulae for computing the moments

$$(1)\ X = \sum_{a,b=1}^{N'} \mu_{ab}\xi_a\eta_b, \quad (2)\ X = \sum_{a=1}^{N'} \xi_a\zeta_a$$

where $N'(=\frac{1}{2}N)$ is the number of sites in one class and ξ_a, η_b, ζ_a and μ_{ab} are certain integers depending on the configuration. In the present paper it is shown (i) that the form (2) serves equally well as the form (1) for the exact evaluation of the moments of any order, (ii) that when surface effects are neglected, the order of terms in M_n and in λ_n should be carefully considered. L. S. G.

548.73 391

An improved algebraic method for the determination of crystal structure from X-ray data. YU, S. H. *Sci. Rec., Acad. Sinica*, 1, 1–2, *pp.* 109–110, *Aug.*, 1942.—Avrami's method [Abstr. 3460 (1938)] consists in solving an algebraic equation of degree $n = m(m-1)$ where m is the number of x, y or z components of the interatomic distances to be determined. The present method is an improvement in that (i) it is only necessary to solve an equation (determinantal) of degree $n/2$, and (ii) the number of terms needed in a given spectrum $H(h, k, l)$ is reduced from $2n$ to $(n/2) + 1$. This means that intensity data of very high-order reflections are not needed, so that some experimental difficulties are avoided. L. S. G.

548.73 392

A new method of analysis of X-ray data for the determination of crystal structure—its application to iron pyrites. YU, S. H., AND HO, C. P. *Sci. Rec., Acad. Sinica*, 1, 1–2, *pp.* 111–115, *Aug.*, 1942.—A modification of the Patterson synthesis is developed and compared with the latter in an application to the analysis of the structure of iron pyrites. The rates of convergence of the two methods are discussed and also the resolving power between peaks on the Patterson diagram. It is claimed that the new method is much more powerful than the classical Patterson method. L. S. G.

548.73 393

Lightning calculations with light. BRAGG, L. *Nature, Lond.*, 154, *pp.* 69–72, *July* 15, 1944.—The trial and error method of reconciling X-ray diffraction measurements with probable crystal structure is simplified by the "fly's eye" device. A master plate is prepared consisting of a pattern of minute holes in an opaque background, the plate is exposed to a single unit of the crystal pattern represented by a cluster of lamps and the pattern formed by a pinhole image of the array is photographed and the plate developed as a cross grating. Hence any proposed structure to be tested is drawn to scale and a lamp placed at each atom in turn and the cross grating spectrum and observed diffraction spectrum are compared. The mol. scattering factor and the use of the Patterson or vector diagram are discussed. N. M. B.

548.73 : 545.824 394

Chemical analysis by powder diffraction. FREVEL, L. K. *Industr. Engng Chem.* (*Analyt. Edit.*), 16, *pp.* 209–218, *April* 20, 1944.—Extensive tabulated data are given on the use of the powder diffraction method in the chemical identification of solids. The

data are for boiler scale, MgO, Al- or Fe-containing substances, and for ambiguities due to solid solution, isomorphism, or structural similarities. General difficulties that may be encountered are discussed.

N. M. B.

548.73 : 548.55 395

A simple vector method for the determination of orientations of cubic single crystals from back-reflection X-ray photographs. DECKER, B. F. *J. Appl. Phys.*, 15, *pp.* 610–612, *Aug.*, 1944.—The method is described and an example is given. The calculations may be made with a slide rule and the process requires 20 to 30 minutes.

L. S. G.

548.73 =6 396

Contribution to the evaluation of the lattice constant by Debye–Scherrer's method. VIERHELLER, F., AND BUENO, A. *Publ. Fac. Cienc. Fis-Mat. La Plata, No.* 173, *p.* 617, *March*, 1944.—Correction. [See Abstr. 1206 (1944)].

548.74 397

An electron diffraction investigation of sulphur nitride, arsenic disulphide (realgar), arsenic trisulphide (orpiment) and sulphur. LU, C. S., AND DONOHUE, J. *J. Amer. Chem. Soc.*, 66, *pp.* 818–827, *May*, 1944.—From electron diffraction measurements the S_8 mol. has a regular puckered ring with S–S 2·07 ± 0·02 Å and angle S–S–S 105° ± 2° and shows rather large amplitude of thermal vibrations; As_4S_6 has As–S 2·25 ± 0·02 Å, angles As–S–As and S–As–S 100° ± 2° and 114° ± 2°. Mol. structures of As_4S_4 and S_4N_4 could not be unequivocally established but cradle-shaped configurations of an alternating eight-ring are satisfactory. In S_4N_4 there is a bisphenoid of S and a square of N atoms with N–S 1·62 ± 0·02, S–S 2·69 Å, angles S–N–S and N–S–N 112° and 106°; whereas As_4S_4 has a bisphenoid of As and a square of S atoms with As–S 2·23 ± 0·02, As–As 2·49 ± 0·04 Å and angles As–S–As, S–As–S, and S–As–As 101° ± 4°, 93° and 100°. The structures, and more particularly those of As_4S_4 and S_4N_4, are discussed in relation to their chemical properties.

W. R. A.

549.211 : 536.413.3 *see Abstr.* 211

549.211 : 539.32 *see Abstr.* 310

550.34 398

Bibliography of seismology, July to Dec., 1943. HODGSON, E. A. *Publ. Dom. Obs., Ottawa, No.* 14, *pp.* 233–252, 1944.—[See Abstr. 1462 (1944)].

550.341 399

Wavelet functions and their polynomials. RICKER, N. *Geophysics*, 9, *pp.* 314–323, *July*, 1944.—The wavelet functions used in the previous paper [Abstr. 1893 (1944)] are extended, a modified notation is adopted, and 24 of the polynomials are given, together with their roots. Expressions are given for the displacement, velocity and acceleration-type wavelets.

550.8 : 553.98 *see Abstr.* 418

550.831 : 550.838 400

Geophysical survey of the Arkansas bauxite region. MALAMPHY, M. C., AND VALLELY, J. L. *Geophysics*, 9, *pp.* 324–366, *July*, 1944.—Magnetic and gravimetric surveys were conducted over an area of approx. 1 400 sq. miles. The various syenite outcrops are domes or bosses on a large batholith, and other similar domes occur on the batholith but do not outcrop. Drilling on the local geophysical anomalies proved the presence of 10 buried domes, but only 2 project above the upper surface of the Midway clays. The geophysical data indicated the approx. configuration of the buried flanks of the known syenite outcrops, and the portions of these flanks that project above the Midway have been outlined more accurately by drilling. Magnetic surveys extending along the Midway–Wilcox contact from Gurdon to Searcy have proved the improbability of the existence of other syenite masses similar to those found in Pulaski and Saline Counties. A detailed magnetic survey of the Magnet Cove area in Hot Spring County proved that the syenite mass exposed in that locality is an isolated intrusion and entirely unrelated to those of Pulaski and Saline Counties.

550.838 : 550.831 *see Abstr.* 400

551.2 401

Volcanic contributions to the atmosphere and ocean. COTTON, C. A. *Nature, Lond.*, 154, *pp.* 399–400, *Sept.* 23, 1944.

551.44 402

The natural resources of Great Britain. II. Underground waters. BAILEY, E. B. *J. R. Soc. Arts*, 92, *pp.* 545–552, *Sept.* 15, 1944.—A survey of the quality of water available and the requirements.

551.481.1 : 535.43 403

Occasional whiteness of the Dead Sea. BLOCH, R., LITTMAN, H. Z., AND ELAZARI-VOLCANI, B. *Nature, Lond.*, 154, *pp.* 402–403, *Sept.* 23, 1944.

551.5 : 613.1 404

Climate, weather, and man. BRUNT, D. *Endeavour*, 3, *pp.* 87–97, *July*, 1944.—The factors involved in the heat exchange processes of the human body are rate of generation of heat in the body (metabolic rate) and heat losses by radiation, convection and evaporation. This article is a general study of heat exchange processes under various atmospheric and other conditions, in relation to the physiological conditions determining comfort and health; and contains the results of experiments carried out on both clothed and unclothed subjects. Particular consideration is given to the limiting conditions of temperature and humidity for heat-stroke, for varying degrees of physical activity and including the effect of increased ventilation. A tentative classification of climates is given in terms of qualitative observations of comfort or discomfort, and the article concludes with some considerations on the ideal climate.

A. E. T.

551.510.41 405

On the existence of atomic nitrogen in the upper atmosphere of the earth. WU, T. Y. *Phys. Rev.*, 66, *pp.* 65–68, *Aug.* 1 *and* 15, 1944.—Evidence for the existence of atomic nitrogen in the upper atmosphere is presented. It is shown that the absence of certain lines of NI and the absence of continuous absorption which leads to the dissociation of N_2 cannot be considered conclusive evidence against the existence of atomic nitrogen. Relative densities of the *E* and *F* layers are discussed, and it is shown that observations of high density in the *F* layer may be compatible with

he existence of atomic nitrogen. Possible transitions which produce the night sky spectrum are discussed.

551.513 406

Periodic properties of the semi-permanent atmospheric pressure systems. STEWART, H. J. *Quart. Appl. Math.*, 1, *pp.* 262–267, *Oct.*, 1943.—These systems and the belts of westerly winds are the outstanding features of the general circulation of the atmosphere. In a previous paper [Abstr. 199 (1941)] the formation of such high-pressure systems was discussed. The period of the characteristic oscillations of these systems is now determined and found to be of the order of magnitude of years. The meteorological significance is pointed out. L. S. G.

551.513 = 3 407

The deterioration of hot and cold air masses through the action of exchange. JAW, J. J., AND GUH, J. S. *Sci. Rec., Acad. Sinica*, 1, 1–2, *pp.* 140–145, *Aug.*, 1942.—The equation for stationary exchange is

$$V_x\frac{\partial s}{\partial x}+V_y\frac{\partial s}{\partial y}+V_z\frac{\partial s}{\partial z}=a^2\frac{\partial^2 s}{\partial z^2}$$ where $V=(V_x, V_y, V_z)$

is the velocity of the air current. The one-dimensional case is solved with and without temperature inversion and some numerical examples are studied.

L. S. G.

551.521.1 : 615.83 408

A daily record of ultra-violet solar and sky radiation in Washington, 1941 to 1943. COBLENTZ, W. W., AND STAIR, R. *J. Res. Nat. Bur. Stand., Wash.*, 33, *pp.* 21–44, *July*, 1944.—A description is given of a photo-electric ultra-violet-intensity meter and automatic integrating and recording apparatus for measuring the biologically effective component of ultra-violet radiation, of wavelengths 3 132 Å and shorter, from the sun and the entire sky, incident on a horizontal plane, under various meteorological conditions. Methods of standardization, in abs. value, are described (see RP1542 for supplementary data). A continuous graphical record is given. The monthly totals in abs. value (mWmin./cm.^{2}) are shown graphically. On the clearest days the radiation ranges from about 180 μW/cm.^{2} in midsummer to about 30 μW/cm.^{2} in midwinter. A series of erythema tests is given, correlating the physical (radiometric) measurements with the physiological reaction of the untanned skin.

551.577.33 409

Smoke and rain. BIBBY, J. R. *Nature, Lond.*, 154, *p.* 434, *Sept.* 30, 1944.

551.579.5 : 537.311.5 410

The water table, equipotentials and streamlines in drained land. CHILDS, E. C. *Soil Sci.*, 56, *pp.* 317–330, *Nov.*, 1943.—The equation of flow of ground water to parallel drain lines is also the equation of 2-dimensional flow of electricity in a sheet conductor. The construction of the sheet and circuit is described and illustrated. Three sets of experiments show (*a*) how the water table falls with increase of drain dia., or with reduction of drain separation; (*b*) the relation of water-table height to rate of rainfall; (*c*) the influence of the depth of the impermeable floor below the drains. The formula giving an elliptical water-table section is not in accordance with the requirements of potential theory. C. J. G.

551.579.5 : 631.415.1 411

Measurements of *p*H with the glass electrode as affected by soil moisture. DAVIS, L. E. *Soil Sci.*, 56, *pp.* 405–422, *Dec.*, 1943.—A study was made of the operation of the glass electrode, the calomel half-cell with salt bridge and the valve amplifier, when used to measure the *p*H of soils at low moisture content. In dry soils, commercial valve amplifiers may give erroneous results because the product of the grid current and resistance of the soil yields an extraneous e.m.f. The apparent *p*H obtained in soils of low moisture content depends on pretreatment of the glass electrode. There is no acceptable evidence that dry soils are characteristically more acid or more alkaline than moist soils, and attempts to measure the *p*H of soils below the moisture equivalent are undesirable.

C. J. G.

551.579.5 : 631.432 : 621.317.39 412

A note on electrical methods of determining soil moisture. CHILDS, E. C. *Soil Sci.*, 55, *pp.* 219–223, *March*, 1943.—[Abstr. 105 B (1945)].

551.583.2 413

On the problem of desiccation of the Tarim basin during historic times. LEE, J. *Sci. Rec., Acad. Sinica*, 1, 1–2, *pp.* 146–150, *Aug.*, 1942.—The hypothesis that Central Asia has gradually been getting drier during the past two millenniums is discussed and the conclusions reached are: (i) Owing to the encircling mountains, the Tarim Basin has been extremely arid in historic times. (ii) On the Pamirs and Karakoram ranges, the moisture is relatively plentiful on account of the influences of the western depressions in the winter and of S.W. monsoons in the summer. (iii) The glaciers on the Kunlun ranges have been undergoing slow but continuous diminution due to a milder climate, so the rivers on the northern slopes of the Kunlun have been retreating backward during historical times. L. S. G.

551.593.6 414

Spectrum formed on a cloud. NIGHTINGALE, E. *Nature, Lond.*, 154, *p.* 434, *Sept.* 30, 1944.

551.593.63 415

Abnormal paranthelia. WHITE, P. *Nature, Lond.*, 154, *pp.* 517–518, *Oct.* 21, 1944.

551.594 416

Persistence of luminosity in air. O'DOHERTY, J. J. *Nature, Lond.*, 154, *p.* 339, *Sept.* 9; 1944.

551.594 : 537.591.2 *see Abstr.* 269

552.64 : 538.214 *see Abstr.* 277

553.042 417

The natural resources of Great Britain. I. Minerals. BAILEY, E. B. *J. R. Soc. Arts*, 92, *pp.* 538–545, *Sept.* 15, 1944.—A survey incl. mainly coal, oil, iron, tin, lead, copper and zinc.

553.61 : 631.43 : 539.215 *see Abstr.* 299

553.621 : 548.3 *see Abstr.* 386

553.98 : 550.8 418

Analytical and experimental data concerning a solid hydrocarbon survey of the Fort Collins anticline. TRIPP, R. M. *Geophysics*, 9, *pp.* 367–387, *July*, 1944.—An analysis is made of the properties of sediments and their derived products which pertain to the migration of gaseous hydrocarbons. From a

thermodynamic consideration the zone of secondary mineralization is located and the appearance of radioactive highs over structure is explained. A distinction is made between the types of soil waxes, and an hypothesis is advanced to explain the origin of the petroleum derived waxes. The results of a soil wax survey of a producing structure are presented and discussed.

571 : 53 *see Abstr.* 85

576.33 : 537.531.9 *see Abstr.* 261

576.333 : 591.181 : 537.213 *see Abstr.* 231

576.35 : 517.92 *see Abstr.* 59

576.8.095.14 : [537.531.9 + 539.164.94 + 539.166.94] *see Abstr.* 260

576.8.095.14 : 539.185.9 *see Abstr.* 298

576.8.098 : 537.363 *see Abstr.* 250

577.16B_2 : 541.144.8 *see Abstr.* 363

581.03 : 537.531.9 *see Abstr.* 262

591.111.3 : 532.64 : 537.39 *see Abstr.* 251

591.148 : 535.247.4 *see Abstr.* 164

591.181 : 537.29 *see Abstr.* 242

591.181 : 537.39 *see Abstr.* 252, 253

591.181 : 576.333 : 537.213 *see Abstr.* 231

593.171 : 537.311 *see Abstr.* 243

612.79 : 537.311.3 *see Abstr.* 245

612.79 : 537.312.6 *see Abstr.* 249

612.84 : 535.7 *see Abstr.* 193, 194

612.84 : 535.735 *see Abstr.* 196

612.843.613 419

Current problems of visual research. STILES, W. S. *Proc. Phys. Soc., Lond.*, 56, *pp.* 329–356, *Sept.*, 1944. *Abstr. in Nature, Lond.*, 154, *pp.* 290–293, *Sept.* 2, 1944.—A résumé of the subject, including (*a*) a discussion of random variations in the visual threshold and possible explanations based on quanta variations in the stimulus, (*b*) the different visibility (luminosity) curves which are found under different viewing conditions, (*c*) the phenomena of vision under changing conditions (adaptation and recovery), (*d*) the fundamental response curves in colour vision. The paper concludes with a bibliography. J. W. T. W.

612.85 : 534.7 *see Abstr.* 156

613.1 : 551.5 *see Abstr.* 404

615.37 : 541.18 *see Abstr.* 364

615.83 : 551.521.1 *see Abstr.* 408

616.8 : 534.154 *see Abstr.* 153

622 : 535.371 *see Abstr.* 182

623.5 : 531.55 *see Abstr.* 105

631.415.1 : 551.579.5 *see Abstr.* 411

631.43 : 553.61 : 539.215 *see Abstr.* 299

631.562.3 : 532.69 *see Abstr.* 133

631.563.2 : 536.2 *see Abstr.* 206

632.94 420

Abrasion of soil insects. WIGGLESWORTH, V. B. *Nature, Lond.*, 154, *pp.* 333–334, *Sept.* 9, 1944.

661.713 : 541.64 : 541.24 : 532.133 *see Abstr.* 119

665.5 : 535.33 *see Abstr.* 171

666.1 : 539.434 *see Abstr.* 323

667.2 : 535.371 : 535.54 *see Abstr.* 188

667.5 : 539.501 *see Abstr.* 326

669 : 539.4.01 *see Abstr.* 317

669.14 : 538.2 *see Abstr.* 275

669.14 : 539.431 *see Abstr.* 322

669.14 : 545.82 421

The routine spectro-chemical analysis of steel. YOUNG, L. G. *Engineer, Lond.*, 178, *pp.* 116–118, *Aug.* 18, 1944.

676 : 532.13 : 539.24 *see Abstr.* 303

676 : 532.691 *see Abstr.* 134

676 : 535.653.3 *see Abstr.* 191

676 : 536.468 *see Abstr.* 215

676 : 539.4.019 *see Abstr.* 320

676 : 539.4.019 : 539.217 *see Abstr.* 300

676.11 : 541.127 : 541.144.8 *see Abstr.* 362

677 : 531.717 *see Abstr.* 106

677.001 422

Tentative Textile Standard No. 10, 1944. Standard testing methods for narrow fabrics. *J. Text. Inst., Manchr*, 35, *pp. S7–S40, Sept.*, 1944.—Specifies proposed tests relating to general dimensional and physical properties of narrow fabrics, the special characteristics of elastic narrow fabrics, chemical properties, and colour fastness.

678 : 536.6/.7 *see Abstr.* 221

678 : 536.77 : 532.71 *see Abstr.* 137

678 : 539.388.8 : 532.71 *see Abstr.* 138

778 : 545.83 : 535.247.4 *see Abstr.* 165

778.3 : 535.243 *see Abstr.* 163

778.31 : 535.824 *see Abstr.* 199